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ON THE PSYCHOLOGY AND PHYSIOLOGY OF READING. I.

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In the experimental study of which this is a partial report I have planned to make an analysis and description of the reading process. Until very recently no general attempt has been made to analyze and describe the psycho-physiological processes involved in reading. Isolated studies on the perception of letters, partial investigations of the movements of the eye in reading, etc., have furnished material, and especially, suggestions, valuable for the general study; but neither a synthesis of these partial studies nor any other attempt to tell just what readers do when they read, was to be found. Such work as has recently been done, as the admirable work of Goldscheider and Müller and Erdmann and Dodge, will be considered later.

Some general account of what we do in reading seems to be much needed in view of the fact that reading is one of the most frequently performed psycho-physiological operations, and is fatiguing, often disastrously so. What are the conditions of this fatigue? Do the interpreting processes become tired or the retina or the oculo-motor or accommodation muscles—or is fatigue due to a combination of these causes—or to tiring of the accompanying motorizing or auditizing mechanisms? The answer must finally come from an analytical study.

Moreover, it has been believed, though less strongly at present than a few years ago, that the reading in schools is the cause of the tremendous progress of myopia. What does the eye do in reading that tends to bring such direful consequences?

Again, readers of apparently equal intelligence differ remarkably in speed of reading, some reading four times as fast as others with apparently equal quality of interpretation. Here may be a tremendous loss, which may be remediable in the light of an understanding of the processes involved.

And then typography has been evolving some hundreds of years under stress of economy, not of the eye and brain so much as of printer's paper and printer's ink. Printers and publishers have been industriously developing the system of straight, thin, horizontal lines made up of groups of little black strokes packed in neatly and compactly. But do we know that this development has not been straight away from the arrangement most suitable for quick and easy reading? It is true that fatigued readers have had some selective part in this evolution. But they have been offered a most limited range of variations from which to choose, and the fundamental notion of line arrangement and word arrangement remain as immutable as the fixed species of Aristotle. Can books and periodicals be printed so as to lessen fatigue, to decrease the tendency to myopia, to increase the speed of reading, to permit more fluent interpretation? Can pupils be profitably taught to read faster or more slowly, to visualize or auditize or motorize, in general can they improve their reading method? These are some of the pedagogical problems to be finally solved by such an analysis of the reading process.

To explain fully the "how" of reading would be to write a treatise on the senses and intellect, and, in fact, to say the last word on many of the fundamental problems in psychology. The present study is but a beginning of what should be done in this field. It is hoped that it may at least make the general subject easier of approach.

In view of the fact that the reading process *per se* has been so little studied, and that the many studies bearing on the general problem are of so detached a character, I have thought that historical reference would be most helpfully made in connection with, or introductory to, my own treatment of the different problems, so I shall at once proceed to the discussion of eye movements in reading.[1]

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[1] To the many friends who have assisted me during the progress of his research I wish to offer my grateful acknowledgments. I am peculiarly indebted to Professors Hodge and Sanford for cheerfully incurring the inconvenience involved in serving as subjects for the experiments upon the eye, and to Dr. Burnham for criticism and advice. I wish also to express my gratitude to M. Javal for kindly forwarding to me personal papers bearing on his researches.

Eye Movements.

What does the eye do in reading? Javal[1] found that he had straight continuous after-images of gray lines after reading, and concluded that the fixation point did not leave the line as the eye moved forward. He evidently believed that the fixation point moved over each line in reading.

Finding that the upper half of the letters was most important for reading, as can be seen at once by dividing a line in halves horizontally and comparing the legibility of the upper and lower halves, he concluded that the fixation point moves along between the middle and top of the small letters.

Ahrens[2] by fastening a bristle 10 cm. long to an ivory cup attached to the eye found that it made a straight sweep forward in reading, but the method could not show stoppages en route, and he does not seem to have suspected their existence. Lamare,[3] working with Javal, finding that the movement of the eye in reading was not continuous, but by little jerks (*par saccades*), devised the following method for counting these: A blunt point placed upon the upper eyelid of the reader put in action a microphone, whose sound, transmitted by a rubber tube, made known each movement to the ear of the experimenter the short reading jerks causing a brief sound, while the extensive movements made in passing from the end of the line to the commencement of the next, caused a more prolonged sound. With a little practice he found himself able to count the movements. He was surprised to find that the number of jerks remained the same whatever the distance from the reader to the book. Javal says: "*Cette distance n'avait donc aucune influence sur la grandeur absolue des sections*," and, again, "*il devenait donc évident que le lecteur devise la ligne imprimée en sections précisement aussi grandes qu'il convient pour que l'œil dirigé vers le milieu de la section puisse encore distinguer en vision indirecte les lettres qui en forment le commencement et la fin.*" In this he seems to have generalized from insufficient data, as will appear later, but the observations are interesting.

Javal attaches much importance to the changes in accommodation necessitated, he thinks, as the distance from the eye to the point fixated changes during the movement along the line, and he thinks that these changes of accommodation are produced synchronously with the jerks.

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[1] Various articles, especially *Rev. Scientifique* 1879 and 1881.

[2] *Die Bewegung der Augen beim Schreiben*, Rostock, 1891.

[3] Des Mouvements des yeux pendant la lecture, *Comptes rendus de la soc. française d'ophthalmologie*, 1893, and elsewhere.

Landolt[1] found that the movement of the eye in reading was by jerks, and studied them by directly observing the reader's eye. He had his subjects read slowly, and was thus able to count the jerks (though he may well have thus introduced conditions quite foreign to normal reading). He found that an average of one and fifty-five hundredths words were read per fixation at a distance of 30 cm. Reading of a foreign language required more fixations, as did the reading of disconnected words, of numbers, and of lists of proper names. Landolt finds that the angular excursions of the eye are less as the distance increases, though the absolute amount read per fixation is somewhat increased. He claims that the movements through a small angle are very fatiguing, and that this may account in part for tendency of children to bring the book too near the eye, at the expense of the muscles of accommodation and convergence. Landolt, himself, recognizes the inaccuracy of his means of observation, and guards himself against more than general conclusions.

Erdmann and Dodge[2] also used the method of direct observation, watching the movements of the reader's eye as they were reflected upon a mirror. Their results will be referred to from time to time in reporting my own experimental work. As stated in a previous article,[3] I found myself able to determine by direct observation of the reader's eye that the movement was by jerks, and that the eye certainly moved along each line in ordinary reading, though it often seemed to the reader that it did not. But I considered and still consider the method inadequate to give any accurate account of even the number of movements of the eye (at least with some of my subjects), when they read at usual speed. It certainly could give no account of the extent of movement at each jerk, or of the speed, and in general it was entirely insufficient for the purpose. This was recognized in the work of Javal and Lamare, and I have already referred to its insufficiency in the work of Landolt.

I therefore arranged apparatus to get record of the eye's

[1] *Nouvelles recherches sur la physiologie des mouvements des yeux.*

[2] *Psychologische Untersuchungen über das Lesen, auf Experimenteller Grundlage*, von Benno Erdmann und Raymond Dodge. Halle, Max Niemeyer, 1898. I have elsewhere (*Am. Journal Psych.*, Jan., 1899,) briefly and very inadequately reviewed this most important work. I regret that in the preparation of this article I have not at hand the notes from which I had hoped to make a fuller presentation of some of their results and methods. A fair comparison of our results would involve a critical and somewhat lengthy review of our respective methods of procedure in experimenting. Perhaps it is best, for the present at least, simply to refer the reader to the work itself, which, I hope, may soon be made accessible to those who do not read German.

[3] *American Journal of Psychology*, July, 1898.

movement by a direct attachment to the cornea of the reader's eye. The apparatus at first used has been described in my previous article already referred to.[1] As used later it consisted essentially of (1) a frame for fixation of the head fastened between iron standards, which were clamped to a heavy table; (2) of a light recording arrangement resting on the top of one of the standards, and connecting with a cup capping the cornea by means of a celloidin covered glass filament, or at other times by an aluminum wire, and writing its record on the smoked drum of a kymograph, by means of a light aluminum pointer; (3) of an arrangement for writing a time record on the drum receiving the eye tracings, consisting of a Deprez signal in circuit with a Baltzar interrupting clock set to mark $\frac{6}{28}$ sec.; (4) of a holder for the reading matter arranged to slide on a track allowing of easy adjustment of distance from the reader's eye; (5) of apparatus arranged to write a "spark" time-record on every part of the tracings of eye movements. The spark apparatus as used in most of the experiments was as follows: The secondary current from an induction coil was passed from one pole along the aluminum pointer, and sparked from its point through the smoked paper to the drum, which was connected through the kymograph to the other pole of the secondary circuit. The primary current of the induction coil was furnished by a Grenet cell, and was interrupted regularly by the vibrations of a tuning fork marking 147.4 vibrations per second. In order to reduce to a minimum the electrical resistance in this circuit, and thus get a stronger secondary circuit, this fork was driven by another, a fork of about 50 vibrations, with two Grenet cells in circuit, the 50 fork interrupting itself electro-magnetically. Thus at intervals of about $\frac{1}{150}$ sec. dots of soot were displaced by the spark, as the pointer moved forward, and a record of the eye's speed and movement was written at every point. By using a fast gearing of the kymograph the lengths of the eye's pauses were also recorded in some of the tests. The Deprez signal record at the side also gave the same.

The fixation of the head with reference to the recording apparatus and reading matter was obtained as before by having the subject bite into a mass of partially cooled sealing wax attached to a mouth-piece fastened in the head frame, the imprint of the teeth being preserved when the wax hardened.

The cups used were plaster of Paris of a curvature a very little less than that of the cornea, as light as they could be made and still be handled with safety. A hole was drilled

[1] See also the article by Prof. E. B. Delabarre in the same number of the *Journal*.

through the center of a diameter of 1.7 to 1.9 mm. The cup was placed on the left eye in all experiments.

The eye was rendered anæsthetic by the use of cocaine or holocaine. The latter was found most satisfactory and was used in most of the later experiments. The cocaine usually interfered with the accommodation, the holocaine probably never did so. The eye felt fairly comfortable during the experiment, and the reading proceeded normally.[1] The reader was directed to read by his normal method for the thought. Most of the passages read were taken from the back numbers of the *American Journal of Psychology*, having a line length of 98 mm., the type was 10-point or 8-point.

The tracings show that the eye moves over the matter line by line in all cases or in very nearly all. The movement along the line is in no single case continuous, but by quick jerks of varying length. In reading 89 of the longer lines, varying in length from 60.5 to 121 mm., there were but 13 retraceals,—about one in seven lines. My arrangement of apparatus could not record wanderings of the fixation above and below the line that was being read. There are, however, certain appearances of the tracings which lead me to think that this could have occurred but seldom; but a record in the vertical plane must be obtained before this can be finally determined. I incline to accept the conclusions of Javal on this point, except that I should expect the fixation point to have a somewhat larger range of variation, vertically, than from the middle to the top of the small letters.

The return sweep of the eye is almost invariably unbroken until near the end, where an occasional halt is made apparently to enable the eye to get its bearings in a new line. The tracings from 119 of the longer lines show 21 such stops. These are more numerous in the long line passages than in the shorter ones. This is as we should expect, if the return movement is guided by the peripheral stimulus from the new line's beginning received during the eye's last fixation in the preceding line. Such guidance would be less and less accurate as the length of line increased and might necessitate the haltings that

[1] This last was true so far as either the reader or experimenter could observe. The complexity of the apparatus, and the novelty of having an attachment to the eye, suggest much of distraction. But the subjects were accustomed to doing normal reading amid such surroundings from day to day, and the reader, for the most part, had little direct consciousness of there being any attachment to his eye—the attached eye feeling quite as free to move as the other one. There was some discomfort at times, especially during the removal of the cup, and after the experiment; but during the tests, so far as we can trust the reader's introspection, the reading proceeded as it ordinarily does. In my own case, at least, it seemed to be even a little faster.

the tracings show and the distraction noticed introspectively when we lose the line. However, several of the passages were read with no halt in the return sweep.

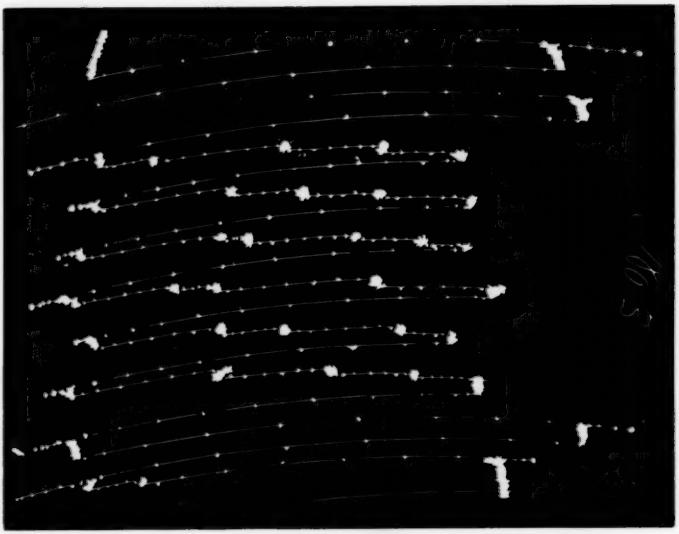
In reading the *American Journal* passages the smallest number of movements in any line was two, the largest seven. The variation, however, is usually not great within a given passage. In reading 30 lines (divided into three readings), subject Hu. averaged 4.8 forward fixations per line, with a mean variation of 0.5. In reading 51 lines (6 passages) under almost exactly comparable conditions, subject Ho. averaged 4.5 forward fixations, with M. V. of 0.6. These readings were at distances ordinarily used in reading, varying from 33 cm. to 42 cm., all but one of the passages being at distances of between 33 to 35.5 cm. The number of fixations per line is not found to vary with distance within these limits, nor indeed is the number decreased very appreciably even when the distance is doubled. The reading of 20 lines (2 passages) of the above by subject Hu. at 35.5 cm. distance, gave an average of 4.7 forward fixations, with M. V. of 0.5. Doubling this distance under otherwise comparable conditions gave an average of 4.5 forward fixations, with M. V. of 0.3. The reading of 47 lines at 35.5 cm. are comparable with a reading of 32 lines at double this distance, 71 cm. The former shows an average of 4.5 forward fixations per line, with M. V. of 0.54. The latter gave an average of 4.48 fixations, with M. V. of 0.45. It should be mentioned that these M. V.'s are averages of M. V.'s within the given passages, and that the variations in the number of fixations from passage to passage was much greater in the double distance passages. Decreasing the size of type seems to have but little effect upon the number of fixations. Thirty lines (three passages) of the smaller size of type, 8-point, from the *American Journal* read at 33 to 35.5 cm. distance, gave an average of 4.9 fixations per line, with M. V. of 0.5. Sixty-seven lines (seven passages) of the larger type of the *Journal*, read under similar conditions, gave an average of 4.7 fixations, with M. V. of 0.54. I have made most use of the results obtained from readings of *American Journal* passages because these are of a line length and type size most frequently met with, perhaps, by the subjects investigated, and I have wished to investigate the process of reading under its most normal conditions. Subjects have been tested, however, with the shorter line lengths.

Nineteen lines of a *Cosmopolitan* article with a line length of 60.5 mm. and the ordinary type size gave an average of 3.6 fixations per line, with M. V. of 0.5. Twenty lines (two passages) from a newspaper column, line length 52 cm., and the ordinary type size, gave an average of 3.8 fixations per line, with M. V. of 0.6, at distance of 35.5 cm. for one subject. With

the other subject 14 lines of the same passage gave an average of 3.4 fixations, with M. V. of 0.5, at 35.5 cm.; and an average of 3.6 fixations, with M. V. of 0.6, at distance of 52.7 cm. Shorter line lengths than this are not ordinarily found in reading, and investigation of reading under these special conditions belongs rather to the consideration of what should be than of what is. The results of some investigations in this field are reserved for a later report.

The tracings show that the eye seldom moves along the whole extent of the line, and that usually the first fixation is nearer the beginning of the line than the last is to its end. In the reading by subject Ho. one passage from the *American Journal* (10-point type) the side to side movement averaged 82.3 per cent. of the line length. In a similar passage the same subject averaged 78 per cent. of the line length. In a similar passage, subject Hu. averaged 82.2 per cent. of the line length when reading normally, and in a similar passage, read at maximum speed, 85.8 per cent. The M. V. is usually quite small in all tracings of this line length, the subject tending to maintain a fairly constant extent of movement throughout a given passage. The indentation, though usually greater at the right, is not always so. In some readings the first fixation must have fallen in the first half of the first word in most of the lines, while in other passages it must have fallen in the second or even in the third word. Individual variations in this respect are not demonstrable as between the readings of the two subjects. For a given passage the subject seems to fall into a way of indenting a certain amount right or left, and maintains this tendency throughout the passage.

The extent of the forward movements in reading is subject of great variations in all cases, and the conclusion of Javal that the eye moved over the extent of matter that could be read at one fixation (usually about the space of 10 letters in his opinion) is negatived at every point. To illustrate the great variability of the forward movements I shall give here the chords of the arcs traversed in some consecutive forward movements in reading a representative passage. The chords are very nearly proportional with the arcs within the limits of these movements. Chords (in mms.), 11.0, 26.0, 3.5, 11.5, 16.0, 13.0, 15.5, 23.5, 17.0, 10.0, 40, 12.0, 22.5, 12.0, 13.0, 13.5, 19.0, 4.0. Another passage, showing perhaps less variation than most of the others, gives 14, 14, 16, 14, 16, 19, 19, 5, 18, 18, 12, 11, 14, 9, 21, 13, 20, 18, 22, 7, 12, 15, 26, 17, etc. The extent of forward and return movements will be given in degrees and minutes in connection with the results of the measurement of speed.



Specimen Curve of 'Spark' Record.

This reproduction, cut by a careful engraver upon a block on which the original tracing had been protographed, shows with great accuracy the sort of record from which the times of the eye movements have been determined. The chief difference between the original and the reproduction is in the breadth of the horizontal lines which are finer in the original.

The curve shows the movements of the eye in reading six lines, preceded and followed by two free movements of the eye each way, in which it was swept from one end of the line to the other, the beginning and end alone being fixated. The broad vertical lines and the round blurs in the reading indicate pauses in the eye's movements, the successive sparks knocking the soot away from a considerable space. The small dots standing alone or like beads upon the horizontal lines, show the passage of single sparks, separated from each other by 0.0068 sec. The breaks in the horizontal lines indicate that the writing point was not at all times in contact with the surface of the paper though near enough for the spark to leap across, as shown by the solitary dots.

The tracing shows clearly the fixation pauses in the course of the line, the general tendency to make the "indentation" greater at the right than at the left, and the unbroken sweep of the return from right to left.

Speed of Eye Movements.

The speed of eye movements has been investigated by Volkmann, by Lamansky,[1] and more recently by Dodge.[2] No direct determination of the speed in reading was made by these authors, but it was assumed by Dodge that the determinations of speed for eye movement in general can be carried over to the reading process, and estimates based on this assumption are given.

Volkmann's method was bad, as Dodge has shown, and on careful examination of the method proposed by him for getting valid results from Volkmann's data I am of the opinion that it cannot be done, and that the results have little value as determinations of speed. Lamansky measured the speed by flashing a pencil of light into the eye at regular intervals, as the eye passed through a given arc, the light passing through the perforations in a uniformly moving disc, and being directed to the eye by a prism, the subject counting the after-images of the flashes appearing during the movement. He found a quicker movement in the horizontal meridian than in the vertical, and the speed increased with the extent of the excursion.

Dodge used a modification of the same method, and found a very much slower speed than Lamansky, which he is unable to explain, except on the ground of individual differences, assuming that Lamansky's work was accurately done. The time occupied in movements through various arcs, as given by these authors, is as follows:

Lamansky.	Dodge.
$6°=10\sigma$	$5°=15\sigma$
$16°=16\sigma$	$10°=16\text{–}20\sigma$
$32°=22\sigma$	$15°=30\sigma$
	$30°=50\sigma$

With the spark apparatus already described I have measured directly the speed of the eye in reading representative passages from the *American Journal*, 10-point type, line length 98 mm., subtending an angle of 15° 14′ at the distance used, viz.: 35.5 cm. The results below give the average arcs described in the movements and the averaged times occupied in traversing these arcs for two passages read by subject Ho., and four read by Hu.[3]

[1] *Pflüger's Archiv*, 1869, p. 418 ff.

[2] *Op. cit.*

[3] I have selected these passages as least subject to error from the conditions of recording. The times given are subject to a certain range of error, which, however, I believe to be comparatively small. No matter how light the apparatus, there must remain a slight delay in starting, due to inertia, and an "overshoot" of the pointer in stopping. (I had first thought that the "overshoot" shown in the tracings might represent, in part, a movement of the eye beyond its intended fixation,

TABLE I.

Subject Ho.

	Forward Sweep. av. arc.	av. time.	Return Sweep. av. arc.	av. time.
First passage,	3° 46′	41.8σ	12° 4′	51.6σ
Second passage,	3° 55′	40.7σ	11° 40′	54.7σ
Subject Hu.				
First passage,	3° 21′	44.1σ	12° 4′	57.0σ
Second passage,	2° 52′	46.0σ	12° 8′	68.3σ
Third passage,	4° 14′	42.7σ	13° 4′	58.1σ
Fourth passage,	3° 27′	48.0σ	— —	—

The forward movements of the eye in reading are found to occupy a tolerably constant time, almost irrespective of the arc traversed. For example, in the first passage read by Ho. (table above) the M. V. of the extent of movement was 34.2% of the average, while the M. V. of the time occupied in these movements was but 10.2%. The smallest and largest arcs described in this reading were as 4 is to 26, while the range of times was as 4 is to 7. Excluding three exceptionally short excursions in this passage the movement range was as 7.5 to 26, and the range of times was 6 to 7. Part of even this small M. V. must be accredited to error in estimation of partial spark intervals, the error to be expected here being much greater than in measuring the corresponding extents of movement, though being of such a nature as to be largely corrected in averaging. So that except for movements of but a few minutes of arc, which would seem to occupy less time, the forward movement of the eye in reading would seem to occupy an almost constant time, with an M. V. that can hardly exceed 5 or 6%, and may be much less.

The measurements of the return movements given in the above table are for the return as far as the first stop. Usually, as has been mentioned, the eye's return sweep was without a

with quick return. But a careful study of the tracings and comparison of tracings made with tubular glass pointers convinces me that the "overshoot" is of the pointer. The eye may not hit its mark at each move, but it comes as near as it needs to get its data.) Perhaps it will be found that the times given above should be increased slightly from these causes.

I append the weight of recording apparatus: Total weight of all apparatus moved by eye—.597 gram. Weight of cup most used—.092 gram. Weight directly resting on eye (cup, and one-half of celloidin-covered glass tube used as a connecting rod) .139 gram.

The pointer that wrote the tracings was suspended so as to barely touch the glazed paper. Care was taken that in the experiments there should be as little as possible of friction or play of parts.

break. The M. V. here, both for times and extents of movement, is small. In all the passages of above table, except the third and fourth read by Hu., the subjects read at normal speed. In the last mentioned passages the subject read at maximum speed throughout. The extent of the movements is seen to be somewhat greater, and there were fewer per line. But the subject evidently was unable to decrease the time required for the movement,[1] and in general there is nothing to indicate that the rate of movement is under control of the will.

Reading Pauses.

The time occupied in the reading pauses is a very variable one. One of the passages read by Ho. gave an average pause of 190.9σ, with M.V. of 48.6σ. Another representative reading by the same subject gave an average of 108.3σ, with M.V. of 32.6σ. In the latter passage, while the M.V. is certainly given correctly, as compared with the average, the average time of the pauses may be somewhat greater, the time being measured in this case by the spark record, and the current having a tendency to use the same path twice when the dots are so close together, as was the case here when the pointer was at rest. In the first passage referred to the time record is taken from the clock record written on the tracing, and is certainly correct as it stands. In another passage read by Hu., 22 reading pauses gave an average of about 183σ, and the same number of pauses from an equivalent passage read by Ho. gave almost exactly the same average (measurements by the clock record). The pauses in retraceals and those on the return sweep are usually shorter than the reading pauses proper, and are not included in these averages.

The passages read at maximum speed show a decrease in the length of the reading pause, and as the speed of movement is not increased it would seem that increase in speed of reading is brought about solely, or at least mainly, by decreasing the number and duration of the reading pauses. Additional tests must, however, be made before this can be conclusively stated.

In general no individual differences have been clearly made out as between the two subjects tested, except that the speed of eye movements appears to be a very little greater with Ho.

[1] In one of these passages an average rate of 9.4 words per second was maintained, as recorded by the signal record from the laboratory clock, paralleling the spark record. In another passage read at maximal speed by Ho., a rate of 12 words per second was maintained—almost a "skimming" speed. These would certainly be maximal rates under any conditions, and indicate that the eye was free to do its fastest work so far as the apparatus was concerned. The apparatus seemed to do its work fully as well, and the tracings and spark records are as clear as when the reading was at normal speed.

The forward movements being so irregular in extent, it seemed that they might be best interpreted as reactions to word stimuli appearing in the right hand periphery at each pause of the eye in reading. It thus became important to know the reaction time of the eyeball to such stimuli.

The minimum time for such reaction was found by Dodge to be between 180σ and 230σ. His method was briefly as follows: From a point first fixated the subject moved to a second fixation point 12 mm. distant on the appearance there of a small letter *c*. Simultaneously with this a large letter O was exposed in such a way as to fall just within the blind spot while the eye remained at the first fixation point, but to become visible the instant the eye was moved. The length of the O's exposure necessary to make it visible was taken as measure of the eye's delay at the first fixation point or its reaction time, subject to a slight correction. The experiments were not extensive enough to determine even the minimum time more definitely than as above stated. The experiment is an extremely pretty one, but seemed to involve some possibility of error, and the times given seemed very long, as compared, for example, with the wink reflex. I have measured the reaction for one subject (subject S.) with the direct attachment apparatus already described. The subject fixated a large letter *A* at a distance of 36.3 cm., and on the exposure of a type-written word 4° 45′ (30 mm.) at the right moved his eye to that point or to a point somewhat beyond. The removal of the card covering the word at the right interrupted an electric circuit starting the Hipp chronoscope, and the reaction movement of the eye threw the end of the aluminum pointer into a trough of mercury, closing the circuit and stopping the chronoscope hands. A preliminary "ready" was given in the ordinary way. A series of reactions to auditory stimuli (produced to the right from the same fixation point) was also made at the same sitting. The stimulus was given by a sharp blow on a telegraph key.

At a later sitting a series of reactions to the same word stimulus given in the same way was made with the hand by pressing a telegraph key, and a fourth series was taken with the hand reacting to the same stimulus, given at the fixation point instead of in the periphery. The results are as follows: Fourteen visual reactions gave as an average 206.9σ, with M.V. of 20.7σ. Eleven reactions of the eye to auditory stimuli gave as an average 191σ, with M.V. of 31.4σ. Twenty-seven reactions with finger key to the peripherally given stimulus gave an average of 180σ, with M.V. of 13.9σ. Thirteen reactions with the finger key to the foveally given stimulus gave an average of 179.6σ, with M.V. of 9σ. From the time for eye reactions probably 10σ should be deducted for the movement occurring

before the pointer reached the mercury. The pointer was necessarily thus removed because of the fact that while the subject was maintaining what he supposed was an absolute fixation, the pointer constantly maintained a tremulous motion, evidenced by the clicking of the chronoscope armature as the circuit was made and broken, and the separation had to be great enough to prevent the possibility of such interference with the chronoscope registration.

The times for visual reaction of the eye showed a marked tendency to decrease even throughout the single sitting in which they were taken. The last six of these reactions (taken immediately after the auditory group which followed the first eight visual) gave an average of 181.7 as against the total average of 196.9. The auditory time showed less tendency to decrease. The visual eye reactions seem to be of the sensory type throughout, the auditory rather of the motor type, the subject remarking upon his tendency to wink and to make general muscular contractions with the auditory reactions. The times thus found for eye reactions are somewhat shorter than those given by Dodge, the minimum for visual stimulus being a little under 170σ, and the tendency being to fall still lower by practice. However, the results are in substantial agreement with his in showing that the reaction to visual stimuli by the eye muscles occupies much the same time as the reaction by means of the hand muscles or others that are under more conscious voluntary control.

In reading it may well be, however, that the reaction is somewhat, even considerably, quicker because of the heightened readiness for the stimulus produced by "associative expectancy," and, perhaps, also by the stimulus to reaction having been actually noted in the remote periphery even while the eye is fixated in the preceding line. The unconscious movements of the eye during fixation, observed in the reaction experiments, give ground for the opinion that "marginal contrast" is due to such movements, and, taken in connection with other phenomena, observed during the experiments with the attachment apparatus, indicate that the supposed fixation point is not at all certain to be the actual one, and that the subjective determination of what has been fixated must not be relied upon when much accuracy is desired. Persons affected with nystagmus will confidently state that they are maintaining fixation when their eyes can be plainly seen to wander through a pretty considerable arc, and the same phenomena seem to be present in a minimum degree in the normal eye. In fact, nystagmus may be regarded as but an accentuation of a normal and constant wavering in the equilibrium of the ocular motor muscles during fixation.

Word Perception and Extent of the Reading Field.

More or less valuable contributions to the study of this part of the reading process have been made by various investigators, beginning with G. Valentine (1844), and continued by Aubert, Donders, Helmholtz, Exner, and Baxt, of the earlier experimenters. These studies give us information as to the time needed for the recognition of letters and of words, and for their enunciation, and discuss to some extent the apperceptive contribution to sense perception in such recognition. The experiments of Baxt[1] give valuable information as to the time needed for retinal impressions (especially impressions from letter or word stimuli) to come to consciousness. It is to be regretted, however, that in most of these studies the actual conditions obtaining in normal reading were lost sight of, and the results cannot be carried over to the reading process.

Cattell[2] investigated extensively the perception of letters and words, and his results are to a considerable extent applicable to the conditions obtaining in reading. He exposed letters, words and sentences on the fall-chronometer, using .01 sec. as the "optimum time" of exposure. He found that from four to five isolated letters could be perceived at one exposure, or three to four short isolated words, and that twice as many words could be seen when given in connection. Short words were read more easily than single letters, and the difficulty of recognizing words did not increase proportionately with their length. For these and other reasons he argued that words are recognized as wholes, and even that sentences are thus recognized. In exposing sentences he arranged the words in double lines so as to get as much as possible within the range of clear vision, thus materially changing the conditions obtaining in normal reading. His investigations of the times needed for the perception and naming of letters, words, etc., need not detain us, as the very different conditions of association and expectation obtaining in normal reading make it very doubtful whether the results are applicable here except in a very general way.

From the side of abnormal psychology Grashey (*Archiv für Psychiatrie*, XVI, S. 654) and Wernicke (*Fortschritte der Medizin*, III u. IV, 1886) have discussed the phenomena of aphasia in their relation to the processes involved in perceiving words and letters, and are led to the conclusion that we read by letters rather than by words.

Goldscheider and Müller[3] took up this question, and made a

[1] *Pflüger's Archiv*, 1871.
[2] Various articles in *Wundt's Studien*, *Mind* and *Brain*, 1885-86.
[3] *Zeitschrift für klin. Med.*, XXIII.

careful study of the conditions affecting our recognition of words and of letters. They conclude that words are perceived both as syntheses of their perceived component letters and as individual units, the latter being, perhaps, the more usual method. They investigate the relative importance for auditory perception of the different parts of words, discussing the possibility of their being determining letters which stand for the word mainly in its memory picture, and are especially necessary for its perception. The beginning and end of a word, especially the first, were shown to be especially important, the word being recognized pretty readily when only these parts were exposed, for what they consider the optimum exposure time, about .01 second. Various other parts of words as the vowels, consonants, etc., were exposed, and sufficed for more or less prompt recognition in many cases. Goldscheider and Müller are inclined to the belief that the visual perception of certain letters of a word arouses the memory of the corresponding sounds of these letters, and that the sounds of the other letters, and thus of the whole word, are called up from association with these. Vowels were thought to be especially important for arousing the motor elements in word perception, and consonants for the auditory elements. Consonants were not thought to be generally more important than vowels for word perception. The relative importance of these elements might depend upon the reader's tendency to be motor or auditory-minded.

My own study, reported in an earlier article,[1] of the effect on speed and extent of recognition of removing the first or last halves of words from passages to be read, show clearly that the first half was much more important for word perception, as it occurs in actual reading. This by no means implies (though, at least, one reviewer of the article seems to have so understood the matter) that the fixation point is upon the first half of each word. Not over one-half or one-third of the words are fixated at all, and though the part usually fixated has not been accurately determined as yet, the results of the experiments of both Dodge and myself indicate that it may be in any part of the word, or even between the words. The *Blickpunkt* of consciousness has been too often and too closely identified with the eye's fixation point, and this identification cannot be maintained for the reading process.

The legibility of isolated letters and conditions affecting their recognition have been carefully investigated by Cattell[2] and Sanford,[3] and have been discussed more or less helpfully by Javal and Cohn. Helpful as these studies have been it seems to me there

[1] *Op. cit.*
[2] *Op. cit.*
[3] *American Journal of Psychology*, I.

is still greater need of the investigation of the legibility of letters in groups and in indirect vision as we normally make use of them. Here they must certainly have a somewhat different, perhaps a very different relative legibility. The need of such investigation has already been mentioned by Dr. Sanford. Then, again, if words rather than letters are the units, as seems to be already established, an investigation of the legibility of words as optical forms for recognition, and the possibility of improvement in their form and arrangement, may be as much in point as the investigation of letters.

Griffing and Franz[1] have made an admirable study of some of the conditions of fatigue in reading, such as size of type, spacing, leading, color and quality of paper, intensity and quality of illumination, etc., but did not attempt any analysis of the reading process. Quantz[2] has made an extensive study of speed in reading and the conditions affecting it, such as practice, eye-mindedness, intellectual ability, etc. His results will be considered in another connection later, but I may say here that it seems to me that no satisfactory determination, or at least no satisfactory explanation, of the conditions affecting either speed or fatigue can be made until the reading process itself is analyzed; and the treatment of this fundamental problem has not, as yet, been attempted in a thorough manner.

As a step in that direction I arranged a series of experiments intended to throw light on the process of perceiving words and sentences as they occur in reading, and at the same time to afford data for determining the extent of the reading field, as it may be called, *i. e.*, the extent of reading matter as ordinarily printed, which the reader can read at one fixation. For this purpose passages were selected from old numbers of the *American Journal of Psychology* of about average difficulty, and of more or less intrinsic interest to the readers. The type was of the 10-point size used in this article, and the arrangement of words and letters was similar. This material was cut out by lines and pasted end to end, so as to make sense continuously on 20 strips of cardboard, each 46 cm. long; the printed matter extending 36.5 cm. on each card. This printed matter was exposed to subjects, section by section, by the Cattell fall apparatus. The matter on the first two cards was divided into sections of 1.75 cm. each, on the third and fourth cards into sections of two cm. each, and so advancing by differences of 2.5 mm. to and including cards divided into 4 cm. sections. The subject sat in a fairly comfortable position with his head in a head-rest, and with his eye at a distance of 35.5 cm. from the reading matter. A white spot on the screen exactly opposite the mid-

[1] *Psych. Review*, 1896. [2] *Psych. Review*, 1898.

dle of the section to be exposed was fixated at a ready signal from the operator about two seconds before the screen was dropped. The falling screen exposed 73 mm. of sense matter of the usual arrangement of type, at about the ordinary reading distance, with the fixation point in the center, for a period of 15σ. As the investigations into the matter of an optimum exposure time by Cattell, Goldscheider and Müller, Quantz and others, gave a decided preference to the shorter times in the vicinity of 10σ it was decided to use them in preference to the longer time occupied in a reading pause, especially as it was not yet known how short the simple reaction time for the eye might be, and it was desirable to keep within this period. Most of the apparatus and screen was hidden from the subject behind a gray paper shield, which was pierced by a 2 x 9.25 cm. slit opposite the part to be exposed. The apparatus was so arranged that a light from a window should fall directly on the exposed matter. In making the tests before exposing a section the context leading up to it was read to the subject up to the last letter, and then the section containing the passage was exposed. The sections were thus given consecutively always with context. Practice tests were made with each subject before beginning the series, and a few exposures were given for practice before each day's experiments. After each exposure the subject dictated or wrote what he had seen, whether words or letters, marking as doubtful those not clearly seen, and reporting it if a word was merely guessed from context. The result of the first exposure was always regarded as the one to be regularly used, but from time to time second, third, and even tenth exposures were made whenever it seemed likely that this would be of value. The study began with the short section cards, but a return series was also arranged on other cards in an exactly similar manner, and given in reverse order, that is, beginning with large sections, and with equivalent but different reading matter. The smaller section cards of this return series were not exposed, however, and it has been found impossible also to apply the same quantitative treatment to them as to the large sections, owing to the constant overlapping of the extents seen from exposure to exposure. Besides the cards in which context was given a series of cards was exposed without giving context, the sections being 5 cm. apart, and given in reverse order, so that though the matter exposed was sense reading, no section made sense with any other. Four subjects have been tested, there being over 640 exposures to a subject when the complete double series was given, and not less than 360 have been given to any subject. I shall first give the results obtained in the investigation of the reading field. The results of the exposure of sense matter without context gives opportunity for comparison of the amount

read in the right and left periphery. The extent of matter read at first fixation continuously and correctly is given in mm. below as *C.* as measured on the exposed line direct. Another measurement (*R.*) is of the total extent of the reader's range of word or syllable perception, as shown by his recognition of a peripheral word or syllable, for example, at the right when not all was read correctly between this and the part perceived farthest on the left.

The extent of line read correctly to the right of the fixation point is given below under *R. C.*, and the corresponding range of perception to the right is given under *R. R.*, all in mm. The measurements under *L. C.* and *L. R.* are for the corresponding correct reading and perception ranges to the left. I give for comparison the measurements from the four cards exposed in four cm. sections with context given up to two cm. from fixation point.

TABLE II.

No Context.

SUBJECT.	C.	R.	R. C.	R. R.	L. C.	L. R.
B	21.33	24.23	9.43	11.50	11.90	12.73
S	10.25	11.25	4.68	4.98	5.57	6.27
T	23.80	27.60	13.90	17.20	9.90	10.40
H	32.40	34.88	19.75	20.90	12.65	13.98
Av. 4 Subj.	21.95	24.49	11.94	13.65	10.01	10.85

Context given to within 2 cm. of Fixation Point.

SUBJECT.	C.	R.	R. C.	R. R.	L. C.	L. R.
B	21.7	22.1	7.3	7.6	14.4	14.5
S	8.8	10.5	4.2	5.0	4.6	5.5
T	23.9	27.3	11.9	14.4	12.0	12.9
H	27.8	28.7	14.3	15.2	13.5	13.5
Av. 4 Subj.	20.55	22.15	9.4	10.55	11.15	11.60

Largest Amounts Read. No Context. One Exposure.

SUBJECT.	C.	R.	R. C.	R. R.	L. C.	L. R.
B	37	40	27	27	10	13
S	45	45	25	25	20	20
T	48	48	40	40	8	8
H	50	50	40	40	10	10

A card given in two centimeter sections was read correctly throughout by one subject with one exposure per section, and large parts of 2.5 cm. cards were similarly read. Usually, however, the special conditions of experimentation caused breaks here and there, even when the fixations were near together.

The fact that exposure of one section permitted reading into the following section which occurred from time to time prevents quantitative treatment of the result except for the cards given in large sections. The data, however, offer much of suggestion for a theory of word and phrase perception. The subjects were instructed to state just what they saw, whether of words or letters. Almost invariably words are given. Only rarely did subjects state that the next word began with certain letters, and it was still more rare that terminal letters at the left were given. From time to time subjects felt that they had seen letters, and that they had been recognized for the instant, but they could not be reproduced after exposure. Smaller forms than single letters, such as commas and other marks of punctuation, were recognized from time to time, subjects stating that they were clearly seen.

There was a general tendency to see phrases and word groups whose components were closely and characteristically associated. This seems to be at the foundation of the tendency noted in all subjects and constantly, to read most at one or other side of the fixation point, instead of in symmetrical arrangement about it, as the conditions of clearest vision would seem to demand. To illustrate, note the appended consecutive measurement for subjects T and B:

TABLE III.

Subject T.				*Subject B.*			
L. C.	R. C.	L. R.	R. R.	L. C.	R. C.	L. R.	R. R.
20	25	20	25	5	0	5	0
7	19	7	19	12	6	12	19
17	10	17	10	13	18	13	18
0	0	5	0	24	0	24	0
9	15	9	15	9	15	9	15
2	13	14	13	14	13	14	13
17	4	17	29	18	4	17	23
10	8	10	8	10	8	10	8

Thus while the average amounts read to the right and left of fixation point are not so very different (except when preceding context is given), as shown in Table II above, the difference of these amounts for particular exposures is often very considerable, and they are seldom equal. It would be interesting to collate these preferred groups (read to side of fixation point) and

compare them directly with the groups that would have been read if the conditions of clear vision alone had determined what should be read in the periphery. It is not to be supposed that preferred phrases and parts of sentences were those of which a memory image already existed in the mind of the reader. Many of the combinations read most easily undoubtedly had never been seen before. But the *form* in which they were cast was a familiar form, in which the sequences were such as to run parallel with the habits of expectancy formed in the reader's mind by long experience with such sequence series. In general the more the word groups tended to resemble isolated words, as when divided by punctuation marks, the less easily they were read. Prepositional phrases, substantives with a series of modifying adjectives, or with a closely linked prepositional phrase modifier, series of any kind which had a rhythmic swing were preferred. Certain words, usually rather unfamiliar ones, presented peculiar difficulties. It seemed almost impossible to bring about a recognition of them by repeated exposures when the subject failed to perceive them at the first. The word "titillation" was exposed to one subject ten times successively before recognition had proceeded so far as to call it "tilitation." All subjects had difficulty with this word; the letters would be clearly seen, but, apparently, could not be remembered long enough to enable the subject to construct the word. "*Raison d'être*" was a combination offering similar obstacles to construction from its component letters. It would be interesting, did space and time permit, to give concrete examples of misreadings, and of various other more or less significant phenomena noticed in the experiments.

Perhaps the chief value of these experiments has been the opportunity which they gave of somewhat extensive observation, at first hand, of the process of perceiving words and other reading-units. I hope, in a later article continuing this report, to sketch an outline of a partial theory of word and sentence perception, which has been suggested and supported by the phenomena observed.

DISTURBANCES OF APPERCEPTION IN INSANITY.[1]

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The relation of normal psychology to pathological mental states has up to the present time been almost disregarded, chiefly by reason, on the one hand, of the uncertainty of psychological theories and, on the other, of the insufficiency of classified data. Those having immediate charge of the insane, and most psychiatrists as well, have contented themselves with formulating working classifications of insanity, which, of course, have a value independent of scientific considerations. But within the last few years, chiefly through the work of Kraepelin and a few others, both parties have had an awakening in this direction. The psychologist is beginning to see that the facts of nervous pathology and defective mental states form one of the most illuminating side-lights of his science, while the physician dealing directly with insanity is learning that the way to arrive at a knowledge of his patient's condition and the best method of treatment can be ascertained only on the basis of a well-grounded psychology. Some effort has already been made to place the work of the asylum on a surer scientific basis, as may be seen from the last report of the Worcester Asylum. The present paper, based principally upon a study of delusional insanity, contains merely tentative positions, intended to show in a general way how the facts of normal psychology and insanity may be brought into closer relationship.

The word apperception has a history of various uses and applications. Before the rise of modern psychology and with philosophers such as Leibniz and Kant, the term has a peculiar metaphysical significance, which use we must exclude in the interest of science however well it satisfies our speculative inclinations. With Herbart, again, the word means the assimilation of a new element to a given mass, in which the new element loses entirely its distinctive identity. At the present time the word as used by psychologists may have especial reference to one of three facts: (1) the fact of attention or clear consciousness, (2) the peculiar organization of the mental contents which

[1] Paper read before the Association of Assistant Physicians of Hospitals for the Insane, Cleveland, O., September, 1899.

makes clear consciousness possible, and (3) the conative processes which make consciousness a changing and active instead of a fixed organization. Wundt found in the first of these the point of departure for his doctrine of apperception. His effort was to explain the fact that at any given moment consciousness exhibits a series of gradations from the point of greatest clearness to entire obscurity, or, to use his own metaphor, the fact that there is a *Blickfeld* or field of consciousness, certain portions of which stand at the *Blickpunkt* or point of clearest vision. But in view of the sensationalistic theory that the clearness of consciousness is determined directly by objective conditions, Wundt finds it necessary, in order to justify his theory, to show that the clearness of apperception has a more comprehensive meaning than the mere intensity of sensation. This is proved in general by two facts, (1) the ability of the *Blickpunkt* to move over the entire field of consciousness under the same set of external conditions, and (2) the inverse ratio existing between the number of ideas apperceived and the degree of clearness of any one of them. In this way Wundt justifies the claim of apperception to be a mental process possessing relative independence.

The fact that at any given moment one idea rather than another appears in clear consciousness points to some kind of organization of the mental contents and to some kind of interaction. The study of apperception in this direction has been most completely carried out by Dr. Stout. With him the term means the organization and activity of "systems" or unified groups of sensations ("Analytic Psychology," Bk. II., Ch. V–VIII). Under this view perception is not a process independent of apperception, functioning only in the acquisition of raw material, but is itself a process of the apperceptive activity. A sensation does not, so to speak, force itself into consciousness and lie loose and isolated until it finds its place, but its very reception is conditioned by the reaction upon it of consciousness as a whole. The activity of consciousness is then essentially synthetic. A group of sensations are fused together in such a way as to form a system which, when its formation is relatively complete, selects one of its elements to represent the whole. For example, when I see any object, as a book, there is present a whole complex of tactile and kinæsthetic sensations of which I am unconscious in the act of perception. Being a visualizer, if I close my eyes and feel raised lettering, I can get no idea whatever of what the letters mean. This shows that in the synthetic grouping of sensations in my consciousness visual elements emerge and, so to speak, assume the leadership of the groups. These primary groups again combine into more comprehensive systems, each in turn represented by

one of its own elements. The mental contents then seem to have a compacted hierarchical organization comparable to that of an army, in which each of the subordinate units, represented in its head, is subsumed into the one above it. This organization is not to be thought of as static, but rather as interactive. In fact, this view is the only one that can explain the third set of phenomena included under the term apperception — the 'forces' of mind. With Wundt activity issues in little more than a very indefinite *Thätigkeitsgefühl*, while, according to this conception, the conative processes form the very conditions which make the 'field of consciousness' possible.

Let us now substitute words of psychological usage for the somewhat abstract terminology hitherto employed. *Sensation*, *idea* and more or less complex *associations of ideas* stand for successive stages in the hierarchy of conscious systems. There is a dual activity in consciousness to which we shall refer again, namely, the functioning of all the subordinate systems in the formation of a judgment, and the activity of judgment or the organization of consciousness as a whole in the reception of new sensation elements. With this very general statement of the theory of apperception, we will now proceed to discuss some of its most apparent disturbances manifested among the insane. It is to be remembered that in dealing with apperception we are passing beyond the field where psychology has most successfully applied exact experimental tests, so that our theories lack in large measure that experimental certainty which science so much desires. Again, the difficulties in the way of an experimental investigation of mental disturbances are apparent without mention. Yet, practically, all studies of insanity on the psychical side must deal with disturbances of apperception. Says Kraepelin: "Was wir heute untersuchen können, sind vielmehr im wesentlichen nur die Auffassung von Sinnesreizen, das Gedächtniss, die Vorstellungsverbindungen, die Auslösung von Willensantrieben, und die Ausführung von Muskelbewegungen" (Psych. Arbeiten, Bd. I, p. 30). On the physiological side microscopy has yet to win its greatest victory in the study of living tissue. Still its triumphs in the past make us optimistic in regard to its future attainments. As yet our knowledge is limited to certain forms of degeneration manifested in cortical areas and association fibers. As to the inner changes of the cell and the functioning of the fibers we know almost nothing.

It is impossible to make any general statement as to how insanity begins. It may be seen from Kraepelin's studies in *künstliche Geistesstörungen* that so far as concerns therapeutically induced mental disturbances, no definite method of attack can be postulated. The same is apparent to any one familiar with the various forms of insanity. Even in dementia, by which

is meant a general nervous and mental weakening, an indefinite number of mental elements may be picked out as seats of disturbance, while others are in only a small degree impaired. Except in idiots and the very worst dements a certain residuum of normal activity seems to go on automatically. This would indicate that while the connections between systems of different strata may be disturbed or destroyed, there is still an associative connection between co-ordinate systems: moreover, that this associative connection is more pronounced the lower we go in the hierarchy of the conscious contents. The matter is somewhat more accessible in delusional insanity. Here we can trace with some degree of definiteness the manner in which the apperceptive function is disturbed.

We have seen that the highest activity of consciousness regarded as a unitary system is represented in the formation of the judgment. This central representative system is what is commonly spoken of as the "point of view." This system, whether we are conscious of it or not, is implicitly present in every judgment we form, and, so to speak, stands for the integrity of the mental life. Delusion may be defined as persistent error of judgment, by which we mean a disturbance of the relationship existing between the "point of view" and the ideas which it dominates. This disturbance may be of more or less permanence, and may issue in only a slight modification or a complete destruction of the controlling system of consciousness. Let us consider a quotation from Mercier. "A man might assure us repeatedly and day after day that he was Emperor of China, but if he conducted his business successfully, and if his conduct toward his servants, his family, his friends and all his surroundings, was normal and proper, we should never consider him insane. But if he were to go to town with a yellow silk umbrella we should begin to look upon him with suspicion; and if he were to send yellow buttons to distinguished strangers as a mark of distinction and favor we should no longer doubt that he suffered from insane delusion" (Sanity and Insanity, p. 103). The author uses this illustration to prove that the test of insanity lies only in conduct. The question might be raised as to whether a man's conversation cannot be considered a part of his conduct. I can see no reason why the man should not be considered sincere in his assurance, and his case one of mental aberration, between which and insanity proper only an arbitrary line can be drawn. As a matter of fact this is just the way in which many cases of delusional insanity develop. Systematized delusions may grow up very rapidly or very slowly, but they never spring into being simultaneously. If a man confidently assures us that he is Emperor of China, it is only a matter of time until he will perform acts such as carrying a yellow

umbrella and sending yellow buttons. Through some cause which lies within the province of the pathologist or the sociologist, a certain unified system of ideas is unduly emphasized in consciousness. At first its only effect is an abnormal absorption of attention as a more or less isolated unit, but gradually it modifies or supersedes the "point of view" until under it, as the controlling element, the subordinate units of consciousness are systematically arranged even down to the smallest details. I have in mind the case of a woman under my observation who believed that she was the mother of Jesus, and under this idea had a beautifully elaborated system of delusions pertaining to her past life, her future intentions, her presence at the asylum and her daily habits of life. In many cases of systematized delusions, however, the original point of view is not destroyed, but only modified. Thus the business man thinks he is making great commercial ventures, the scientist significant discoveries, and so on. All degrees of this modification may be found from the "queer," "eccentric," "crack-brained," "off," "cranky" person we meet every day, to the most deluded inmate of the asylum.

Another form of delusional insanity claiming our attention is that in which two ideas instead of one come to occupy the prominent place in consciousness. Each of these ideas has its own system of subordinate elements, and the patient passes from one to the other in response to certain accidents, mostly of a coenæsthetic nature. This is a possible method of explaining the changes in identity frequently manifested among insane patients. The disturbance of the apperceptive function may proceed until the power of forming judgments is entirely lost, in which case we find an indefinite number of delusions apparently without connection, based upon as many co-ordinate but more or less isolated systems. When the disturbance reaches the connection between the secondary systems and the ideas of which it is composed the patient is completely at the mercy of suggestion or merely associative connection. Even association is gradually destroyed, when results a state of more or less complete confusion which from the nature of the case is inaccessible for study.

Perhaps the most efficient agent in determining the manner in which delusions are formed is the *feeling-tone* of pleasantness and unpleasantness. These are regarded by most psychologists of the present time as elementary conscious states co-ordinate but not identical with sensations. Sensation is the conscious state attending the reaction of a definite sense organ to stimulation; feeling-tone, on the other hand, attends the reaction of the whole organism, and accompanies the general physiological process of anabolism or catabolism. The surest method of investi-

gating feeling-tones is by studying their bodily effect or accompaniments. These are for pleasantness, increased bodily volume, deepened breathing, heightened pulse and increased muscular power; for unpleasantness the reverse phenomena. We may deduce these general facts in regard to states of feeling. (1) They affect to a greater or less degree the whole of consciousness. (2) They keep the elements to which they are most strongly attached persistently before the attention. (3) They definitely affect all the organic processes in the way of acceleration or retardation. These facts seem to be of the greatest importance in the explanation of certain forms of insanity. Let us suppose that because of some organic derangement a strong feeling of unpleasantness arises in consciousness. It soon fixes itself upon some idea that lends itself readily to the adjustment, for example, the idea of persecution, already containing within itself a memory image of unpleasantness. Thus emphasized, the idea is kept persistently before the attention until it gradually assumes first place in consciousness, when the systematizing process begins. The activity of consciousness being slow and under the constant influence of the feeling-tone, elaboration of delusions is often carried to a wonderful degree of completeness. The history of mania is somewhat different from that of melancholia. Here the activity is so increased that time is not afforded for the formation of systematized delusion, but the attention passes rapidly from one idea to another, each one being for the time the controlling factor in consciousness.

Mention was made in the early part of this paper of the dual activity of consciousness; the associated action of the lower systems in the formation of judgments, and, on the other hand, the action of all the higher systems in the reception of new sense elements. It cannot be supposed, then, that a disturbance of the higher functions can be without serious consequences among the lower activities. These disturbances are variously spoken of as hallucinations, illusions, sensory fallacies, subjective perceptions, and so on. In order to understand the meaning of such disturbances it is well to find at the outset where they are most prevalent. That they exist to a limited extent in normal life no one can doubt. In insanity they exist in varying degree in mania, melancholia, dementia and delusional insanity. Concerning dementia Krafft-Ebing says: "As the mental images become less complex and vivid as memory fades and the patient gradually sinks into profound psychical weakness, hallucinations and illusions become ever rarer; the former, indeed, are almost unknown in advanced general paralysis, and the latter occur but seldom" (Die Sinnesdelirien, p. 48). To this let us add a quotation from Parish: "Delusional Insanity and Paranoia abound in hallucinations, so much so that some forms classed

under this head are designated 'hallucinated insanity' and 'paranoia hallucinatoria.' The sense-deceptions of delusional insanity are vivid in their externalization and resemble in their content the fixed ideas which they embody" (Hallucinations and Illusions, p. 23). The prevalence of fallacious perceptions in delusional insanity, and their gradual disappearance in progressive dementia, will immediately suggest some close connection with the systems whose derangement we have been considering. We will even venture so far as to say that they depend entirely upon the insufficient or abnormal activity of judgment. Kraepelin (Psychiatrie, p. 79) tells us that the influence of hallucinations upon the mind is not chiefly due to their strength as elements of perception, but to the close relationship in which they stand to the contents of the patient's habitual thought. Parish seems to take the opposite view that, instead of delusions causing fallacious perceptions, the latter cause the former. Speaking of the dangers attending auditory hallucinations he says (*op. cit.*, p. 30): "they lead him (the patient) to seek for explanations, and thus bring delusive ideas in their train." (*Cf.* Kandinsky, "Zur Lehre von den Hallucinationen," *Arch. für Psych.*, XI.) It seems to me that here consideration is given rather to the way in which the patient manifests his disorders than to any causal connection. We might better say that the patient is unconsciously searching for evidence to support his delusion, and when it presents itself in the form of fallacious perception he naturally explains it by the preconceived delusion. Again, this view is supported by the whole mass of psychological facts pertaining to perception. We must remember that ideas or combinations of sensations are not given to the mind as ready-made copies of external things, but that they are the product of a subjective fusion process. When any sensory element presents itself, all of consciousness displays an activity in its reception and the particular idea to which it has been before apperceived is projected to assimilate it, and the whole idea in combination with this element is externalized. Consequently, in the sense of externalized subjective elements, all of our perceptions are illusions. Evidently, then, this side of the matter can have no part in the definition; so that the only question left for consideration is the fallacious nature of the perception. This we must again say is a matter dependent upon judgment. The idea that the sun moves round the earth is considered an illusion at the present day, but it was not in ancient times. We simply occupy a different "point of view," and judgment corrects the perception. The same fact appears in connection with the common illusion of flying houses and trees when viewed from a moving train. A memory image of motion is attached to the impressions actually coming in. The

process of judgment serves to break up this complex and to relegate this image to the system to which it really belongs. When this corrective process is fully carried out the landscape no longer seems to move. Herein lies the difference between the trained scientific mind and the mind of common sense—the former is able to break up its ideas, and, on the basis of the data available, rearrange the elements in a consistent system. Science is constantly demonstrating to us the illusory character of our everyday perception. What is true of the ordinary man is in much greater degree true of the insane. If the ordinary man is constantly projecting the elements of his thought in perception, it is easy to see how the insane patient, with his abnormal "point of view," can see his delusion in every sensory process. If, again, the ordinary man is not able to draw any line between the subjective and objective factors in perception, we can hardly expect the insane person, with his weakened judgment, to recognize the difference between subjectivity and objectivity. If the foregoing is true, it is hardly necessary for us to indicate the fact that the definition, first presented by Esquirol and commonly accepted since, of illusion as the false interpretation of external objects, and of hallucinations as sensory images without external stimulation, is entirely inadequate. The distinction is based upon a physiological process that is by no means unambiguous, while here we are dealing with a distinctly psychological phenomenon. As Gurney says (Hallucinations, p. 155): "Every psychological phenomenon that takes the character of a sense-impression is a sense-impression. When the hallucinated person says, I hear so-and-so, or I see so-and-so, the words are literally true; for to him a hallucination is not merely like, or related to, a sense-impression, it is identical with it." The same view is supported, but in my opinion with insufficient treatment, by Kraepelin (Psychiatrie, p. 103): "Die Schwierigkeit, Einbildungsvorstellungen von fast sinnlicher Lebhaftigkeit scharf von der wirklichen Wahrnehmung zu trennen, ist die Ursache, warum bei Geisteskranken gerade die Vermischung von Sinneseindrücken mit selbst gelieferten, dem eigenen Vorstellungsverlaufe entstammenden Bestandtheilen eine so verhängnissvolle Quelle der Verfälschung ihrer Erfahrung wird."

In regard to motor disturbances manifested among the insane very little can be said at the present time. It is certain, however, that the old classification of them as diseases of the will is no longer tenable in view of the modern psychological facts. Motor phenomena are now regarded as necessary elements in all mental processes, and are not to be ascribed to a peculiar mental "faculty." It would seem, therefore, that the only genuinely motor disturbances are to be found in cases such as

epileptic convulsions, verbigeration, etc., while what are known as imperative ideas, obsessions, etc., probably have normal motor processes, with the real seat of disturbance in the apperceptive connection of ideas.

In conclusion, it must be admitted that the almost infinite variations in the forms of insanity make the present treatment of the subject seem very general and perhaps artificial. Moreover, those dealing in a practical way with the insane need most a specific, definitely determinable classification. It is to be hoped that the rapidly growing mass of psychological facts will soon enable us to speak with more precision. Our endeavor here has been to call attention to some of the work already done along this line and to suggest directions for further research.

SENSIBILITY TO PAIN.

By EDGAR JAMES SWIFT, State Normal School, Stevens Point, Wis.

The purpose of the following experiments was to test further the relation between sensibility to pain and age, to learn whether mental ability influences this sensibility, and, if possible, to determine the effect of mental fatigue on the threshold of pain.

The instrument used was Dr. Arthur MacDonald's temple algometer.[1] By gently pressing on the temples with the flannel-covered disk at the end of a rod running through a cylinder and connected with a spring in the cylinder, the threshold of pain was determined in grams for each temple. The subject was instructed to say "stop" the moment the pressure felt "the least bit disagreeable."

The two following tables, one for males and the other for females, give the threshold of pain in grams for the right and left temples, as indicated at the top of the third and fourth columns: The first column gives the nearest age of the subjects, and the second the number of subjects whose tests enter into the average.

It will be noticed that the left temple is more sensitive than the right. This agrees with the results already found by Dr. Arthur MacDonald[2] and Miss Carman.[3]

This sensibility to pain decreases with the increase in age until about 18 or 19 years, when it seems to remain nearly stationary, varying slightly with different individuals and hence with different groups. This variation, I think, is due to other causes than age, as I shall show later in this paper.

Females at all ages are, in general, more sensitive to pain than males.

I did not find the "increase of obtuseness to pain from ages 10 to 11" to which Dr. MacDonald calls attention.[2]

In order to find the effect of mental fatigue on sensibility to

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[1] Described in the *Psychological Review*, July, 1898.
The credit for starting this line of research belongs to Dr. Arthur MacDonald, of the Bureau of Education at Washington, and this paper is offered as a contribution to his valuable work.

[2] Further Measurements of Pain. A paper before the American Psychological Association in New York, December, 1898. Also Report of the Commissioner of Education, 1897-98, Vol. I, pp. 1111 and 1113.

[3] *American Journal of Psychology*, April, 1899, p. 393.

TABLE I.

Males.

Nearest Age.	Number of Persons.	Right Temple.	Left Temple.
7	2	875	875
8	2	650	625
9	5	1065	1050
10	8	825	800
11	8	978	940
12	6	1037	1012
13	11	1052	1036
14	5	1450	1450
15	10	1300	1305
16	15	1666	1651
17	12	1735	1729
18	7	2021	1992
19	15	1790	1708
20	15	2136	2188
21	9	1808	1788
22	6	1833	1858
23	5	2260	2140
24	5	1860	1860
25	4	1750	1675
26	1	1650	1650
27	1	1150	1150
31	1	2450	2400
35	1	3600	3600

TABLE II.

Females.

Nearest Age.	Number of Persons.	Right Temple.	Left Temple.
7	1	800	850
8	2	625	600
9	6	850	800
10	5	680	690
11	6	837	879
12	8	881	893
13	7	1115	1065
14	17	1294	1279
15	12	1735	1729
16	11	1302	1293
17	18	1562	1520
18	34	1624	1634
19	29	1700	1698
20	25	1682	1666
21	22	1939	1936
22	16	1834	1775
23	12	1708	1652
24	9	1661	1605
25	4	1437	1450
26	4	2087	2050
27	5	1990	1980
29	1	2750	2750
30	4	1862	1962
31	1	2300	2150
32	1	3000	2950

pain two sets of tests were arranged. The first series was carried out during the middle and last part of the school term, when the pupils were tired from their work, and the second series was taken during the first week after a ten days' vacation, when the pupils were comparatively fresh. The two sets of tests, called in the tables "first test" and "second test," were, in every instance, made on the same pupils. That this may be clear let me refer to Table III. In the upper line are the results from seven children, 10 years of age, whose right temples averaged 839 grams with 800 grams for the left temple in the first test. In the second test, immediately after the vacation, these same children averaged 1,239 grams and 1,192 grams for the respective temples.

The dynamometric test of the right hand, unless the subject was left-handed, taken each time just before the algometer was used, served as a basis for a comparison of the physical condition of each subject at the time of the two tests. A Narragansett dynamometer was used, and the measurements were in kilograms.

The results to which I now desire to call attention are found in Tables III and IV, which follow:

TABLE III.

Males.

Nearest Age.	Number of Persons.	FIRST TEST. Right Temple.	Left Temple.	Dynamometric test.	SECOND TEST. Right Temple.	Left Temple.	Dynamometric test.
10	7	839	800	18.4	1239	1192	17.2
11	8	987	940	20.2	1337	1156	20.1
12	5	1055	1025	24.	1650	1595	22.
13	11	1052	1036	26.7	1286	1236	27.
14	3	1466	1483	35.3	1491	1441	31.8
15	7	1432	1439	35.	1628	1560	36.7
16	10	1602	1582	45.1	1470	1457	40.4
17	10	1702	1700	46.	1737	1705	49.2
18	5	1780	1750	50.	1675	1640	51.6
19	10	1795	1710		1822	1760	
20	10	2180	2188	49.6	2017	1952	51.4
21	5	1980	1960		1860	1815	
23	5	2260	2140	54.2	2320	2245	58.4
24	3	1966	1950	60.	1450	1425	57.6
25	4	1750	1675	59.7	1393	1387	59.5

TABLE IV.

Females.

Nearest Age.	Number of Persons.	FIRST TEST. Right Temple.	Left Temple.	Dynamometric test.	SECOND TEST. Right Temple.	Left Temple.	Dynamometric test.
10	7	750	750	17.	987	962	22.
11	5	825	875	17.4	935	870	18.6
12	6	895	929	16.6	1220	1187	17.5
13	6	1152	1127	23.5	1322	1291	24.3
14	16	1300	1290		1307	1270	
15	9	1511	1505	30.8	1666	1750	25.1
16	11	1302	1293	27.9	1377	1340	29.4
17	12	1554	1514	25.8	1616	1562	30.3
18	22	1560	1573		1710	1669	
19	20	1551	1568	28.9	1763	1723	28.5
20	19	1627	1621		1536	1485	
21	17	1901	1902	33.1	1766	1717	33.4
22	8	1643	1625	33.2	1646	1603	31.8
23	6	1729	1737	31.8	1979	1933	32.1
24	7	1421	1400	34.8	1960	1892	35.7
26	2	1800	1750		2050	1937	
27	2	1850	1900	32.	2100	2050	32.5

An examination of these two tables shows:

1. That sensitiveness to pain varies at different times. It will be noticed, however, that the relation between the sensibility of the two temples remains about the same. The variation is regular. When the sensibility of one temple increases or decreases the other temple varies in the same way. The sensibility of the left temple is always a little more than that of the right.

The cause of this variation is probably to be found, in large part, in the bodily condition and in the degree to which the subject is affected by his bodily condition. In the present instance fatigue resulting from school work was undoubtedly an important factor in causing the variation.

2. Fatigue seems to have more effect on the younger boys and on females. The variation is more constant with these two classes. Their second test shows less sensitiveness in a greater number of cases. This is as might be expected, since the nervous system of children has a freer sway than in those who are older. Inhibitions play a less prominent part in the mental life of children. Hence they are more easily influ-

enced by their physical condition. Probably the same explanation may be made for the greater variation of females. Young men, being stronger physically, would not be so easily fatigued by school work. Table III shows that all the boys from 10 to 14 years were less sensitive to pain after the vacation than during the term's work, while Table IV gives only one group below the age of 20 years in which the girls were not less sensitive to pain after the vacation.

3. The dynamometric tests indicate that the physical strength of the subjects did not vary much when the two tests were made. As might be expected their strength averaged a little more after the vacation, but the difference was slight. It would seem from this that the comparative indifference to pain after vacation is to be accounted for by the increased tone of the body, and especially of the nervous system, rather than by any marked increase in physical strength.

In order to find out whether mental ability has any influence on sensibility to pain the pupils were divided into five groups, (1) very dull, (2) dull, (3) fair, (4) good, and (5) excellent. The advantage of this division over one of two classes, *i. e.*, "dull" and "good" or better, is evident. When we have to decide between "good" and "dull" we put a large number in the "good" group that do not properly belong there. Still we cannot call them "dull." Again "good" does not give us an idea of unusual ability, and so we are certain to put into this group a rather heterogeneous lot of intellects. If, however, we have a "fair" group below the "good" and an "excellent" above, we sift the pupils according to ability much more accurately.

Only those regarded as "dull" or "very dull," on the one hand, and "excellent," on the other, are included in the following estimate. Those designated by their teachers as "fair" or "good" were not considered. In this way a wide difference was made between the ability of those in the two groups.

TABLE V.

DULL.				EXCELLENT.			
Number of Persons.	Ages.	Right Temple.	Left Temple.	Number of Persons.	Ages.	Right Temple.	Left Temple.
			Males.				
32	11–24	1849	1826	21	11–26	1641	1576
			Females.				
51	11–25	1688	1671	32	11–30	1331	1321

It will be seen from Table V that those of "excellent" ability are much more sensitive to pain than those that are

"dull." Miss Carman[1] also found dull children less sensitive, though Dr. MacDonald says, "there seems to be no necessary relation between intellectual development and pain sensitiveness."[2]

The plan of putting all the "dull" pupils into one group, and all the "excellent" ones into the other, as previous investigators seem to have done, is subject to error because the majority of "dull" children is found in those ages in which "excellent" ones are rare, *i. e.*, from 14 to 18 years. The "excellent" pupils, again, are found among those up to 14 years and from 18 years on. As sensitiveness to pain varies with age up to about 18 years it is possible that this age variation might so far affect the variation due to ability as to seriously alter it. In order, as far as possible, to eliminate this error two groups were formed, one of "dull" and the other of "excellent" pupils, and for every "dull" pupil of a given age that entered into the one group an "excellent" one of the same age was placed in the other group. If in any case they could not be paired, the one for which a mate of the other grade of ability could not be found was excluded. To avoid any sort of selection I followed the rule of taking them in order, selecting the first "dull" or "excellent" among those of a given age and the next following of the other grade of ability of the same age. The result is as follows: Males (dull), right temple, 1,629; left temple, 1,618; (excellent), right temple, 1,585; left temple, 1,497. Females (dull), right temple, 1,533; left temple, 1,495; (excellent), right temple, 1,355; left temple, 1,360.

The same difference is evident here as was found in Table V. Those of "excellent" ability are much more sensitive to pain than those that are "dull."

Some thoughts of educational interest suggested by this investigation are:

1. The greater sensitiveness of young children. What has been shown here to be true of pain is also true of reproach and severity in whatever form. Pain is as much a mental as a physiological phenomenon.

2. More attention should be given by teachers to the physical side of education. Everything that lowers the bodily tone should be guarded against. The eye-sight of children, their hearing, food, play, cleanliness and sleep, ought to receive the teacher's attention, and care should be taken not to fatigue them by excessive school work or by keeping them too long at one thing.

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[1] *American Journal of Psychology*, April, 1899, p. 396.

[2] Further Measurements of Pain, December, 1898. Also Report of the Commissioner of Education, 1897-98, Vol. I, p. 1113.

3. The brighter children are more sensitive than the dull. Their nervous system reacts quicker in response to the action of the outside world upon them. Bright children present the difficult educational problems. Their more delicately organized nervous system makes it easy to destroy forever their intellectual possibilities. They need the greatest care and thought, and usually get the least.

4. Fatigue makes the nervous system irritable. When fatigued the brain's reaction is more reflex and less intellectual. The child cannot do his best work, and learns to be satisfied with a poor result. He may gradually accommodate himself to a kind of passive reflex nervous activity when his mind should be alert and discriminating.

STUDIES IN THE PSYCHOLOGY OF ALCOHOL.

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OUTLINE.

I.

PSYCHOLOGY OF THE INTOXICATION IMPULSE.

§ 1. Introduction. Psychological Method.
§ 2. Intoxication among Primitive and Civilized Peoples and among Animals.
§ 3. The State of Intoxication.
§ 4. A Study of Cases of Inebriety.
§ 5. Effect of Intoxication upon Literature and Language.
§ 6. Analogues of the Intoxication Impulse.
§ 7. Résumé and Criticism of Theories of the Intoxication Impulse.
§ 8. Summary of Data, and an Outline of a Theory of the Intoxication Impulse.

II.

EFFECT OF SMALL DOSES OF ALCOHOL UPON THE ABILITY TO DO MUSCULAR AND MENTAL WORK.

§ 1. Résumé of Recent Literature.
§ 2. Experiments of the Writer.

I.

THE PSCHOLOGY OF THE INTOXICATION IMPULSE.

§ 1. INTRODUCTION.

The problem which is outlined in the following chapter, is concerned with the nature and origin of the intoxication impulse, considered in its relations to the mental development of the individual and of the race. The interest in it grew largely out of a desire to know the value of the methods of psychology, as applied to the problems of ethics, for it seems likely that the next important step in ethics will be an appeal to psychology for an explanation of the motives which underlie conduct. Both subjective and objective methods are available in such studies. We can appeal to the introspection of the individual, and we can also infer the nature of mental action as expressed in conduct.

In regard to our present problem, the psychologist's work is (1) to gather facts about the intoxication impulse, as it is

felt, and as it expresses itself in the form of motor activity; (2) to study these facts in their relations to other known facts of normal and abnormal psychology. Apparently one of the most serious faults of method of the sciences which deal with abnormal man, is their tendency to study abnormalities without sufficient regard to the normal conditions from which they are deviations. Take for a single example the criminological method of the Lombroso school. To illustrate the dangers of it, it is sufficient to point to Nordau, whose conclusion that all society is pathological, is the logical result of the indiscriminate search for abnormalities.

It is the business of normal psychology, using both objective and subjective methods to present such a conception of mind as will prevent the dangerous and narrow minded tendency of regarding *all* departures from the so-called type as abnormalities. It must explain the origin of pathological mental variations, and study them as they occur in slight variations from the normal in borderland cases.

§ 2. Intoxication among Primitive and Civilized Peoples and among Animals.

In looking for the origin of an impulse so deepseated and so wide-spread as that toward the use of intoxicants, it is natural to turn to the drinking habits of primitive peoples. To present an adequate account of the use of stimulants and narcotics among them would require a volume. No attempt is made here even to classify or name the various alcoholic drinks which have been used, the purpose being solely to extract the main psychological principles. Alcohol drinking is certainly polygenetic. It has not spread as a custom from one part of the world to another, but is indigenous to many lands, and at various times. Primitive society presents one advantage over civilized society for the study of drinking customs, in that it is far less complex. Yet it can hardly be said that intoxicants have played a less important part among uncivilized than among civilized peoples. Indeed, it is hard to imagine what the religious or social consciousness of primitive man would have been without them. They have created gods; and about their use have crystallized myth and superstition, rite and ceremony in endless variety. State ceremonials, worship, marriage, the funeral, secular festivals, initiatory rites, dances, games, hospitality, care of the sick, preparation for war, consummation of peace, transaction of business, all have served as occasions for intoxication.

Religion. Excitement has often been regarded as an essential part of religion, and it has been induced in various ways as a means of divine worship; for example by violent movement, fasting, self torture and drugs. Epilepsy, chorea, hysteria, have

all been regarded as divine, and have been voluntarily induced. Long courses of training in practices which make the nerves crepitate have been believed to bring the soul into touch with supernatural things. So it is but a special instance of a general belief when intoxication is regarded as god-given or pleasing to the gods. For primitive man this belief was natural, for not only did the ecstatic feeling and sense of increased power suggest this view, but in the dreams which drugs produced, he seemed to enter his heaven and talk with his gods. It is a long way from the primitive soma worship in which all the devotees of Indra became intoxicated to please the god to the decent communion service of our own day; but none of the transitional steps are lacking, and probably this sacrament has a deep ancestral root in some of these early rites.

Suggestions of the use of intoxicating drugs by primitive man, for some purpose, possibly religious, are not wanting. Dawkins[1] speaking of the neolithic civilization in Europe, says that the poppy was cultivated, and that small round cakes have been found which may have been intended for use as a narcotic.

The earliest historical example of a religious cult founded upon intoxication was the soma worship of the Hindus. This has so often been described that a brief mention of it is all that is necessary. The god, Indra, was supposed to be present in the wine, as at a later time, was believed by the Greeks in regard to Dionysus. Both the Zend Avesta and the Vedas speak of a sacred plant, the fermented juice of which was employed in sacred rites. The Hindus believed that the performance of the soma ceremony was highly beneficial for both body and soul. They believed that Indra himself drank soma to obtain strength and victory in battle. They also attributed length of days to its use.

Religious intoxication cults are scattered all over the world among uncivilized people, and there can be little doubt of their independent origin at many times and in many places. A remarkable religious intoxication ceremony[2] has been described recently, which has spread from the Kiawi Indians and associated tribes which formerly ranged from the Arkansas River southward into Mexico, until it has become the chief religion of all the tribes of the southern plains. The ceremony usual takes place Saturday night and lasts until noon the next day. The men sit around the brightly burning camp fire, chewing the intoxicating mescal while a continuous singing and beating upon drums is kept up, interrupted by occasional prayers for the sick and by baptismal rites.

[1] Early Man in Britain, and His Place in the Tertiary Period, p. 293.
[2] Mescal Buttons. Prentiss and Morgan. Medical Record, 1896, I, 258-266.

The Pueblos, another race of American Indians, are described as a sober people who never become intoxicated except as a part of their religious ceremony. Featherman[1] describes a sacred festival of the Yakuts which is nothing more than an elaborate drinking ceremonial. Spencer says that the Dahomans deem it a duty to the gods to be drunk. The Ainos of Japan drink to the gods, as is also the custom of the Polynesians. In Fiji, drinking is accompanied by prayers or chants to the gods. The Patagonians pray to be eternally drunk in Heaven. Among the American Indians intoxication by tobacco was put to religious uses.[2]

Shamanism. A somewhat different religious use of intoxicating drugs is connected with shamanism, a cult practiced among a great many tribes in different parts of the world. The shaman uses various means for producing a condition of excitement in which he sees visions, prophesies, or drives out evil spirits and diseases. Epileptic or hysterical excitement is induced by wild and rapid movements, contortions, beating of drums, confusion, fasting, and drugs. In some cases long training is undergone to produce a nervous condition; young candidates are chosen from among the constitutionally neurotic. This widespread custom among primitive peoples suggests similar cults in the middle ages and in modern times in which various forms of nervous disorders, such as hysteria, epilepsy, chorea, convulsions, and ecstasies were voluntarily induced for religious purposes.

Among many other tribes intoxicants are used to produce this divine state. Among some tribes[3] in the Phillipines the shaman is usually a woman who works herself up to a state of frenzied nervous excitement by means of contortions and copious draughts of fermented liquor. Feasting and revelling follow, until oftentimes at her medicine ceremonies all present become intoxicated and fall into an unconscious state.

The Indians of California, Mexico, Peru and Brazil, all had drug ceremonies which vary in the drug used and in minor matters of form; but in their nature they are essentially alike. Dyer[4] says that the Darien Indians of South America give seeds of datura to children to produce a prophetic delirium in which they reveal hidden treasures. Information about their enemies was obtained in a similar way among other tribes.

Domestic life. There is no important event in the life of the savage which has not been especially celebrated by intoxica-

[1] Featherman: Social History of the Races of Mankind, Vol. IV, p. 249.
[2] See Spencer: Ethics, Vol. I, p. 441.
[3] Featherman: Social History of the Races of Mankind, Vol. II, p. 499.
[4] The Folk-Lore of Plants, p. 103.

tion. Any occasion which excites the emotions, whether it be joy or sorrow, seems to have demanded artificial means of intensifying the feeling. Birth appears to have been celebrated less than other important events of life, and there is comparatively little intoxication ceremony connected with it. Some New Mexican Indian tribes have a peculiar birth ceremony, celebrated only at the birth of a first child. In this the father becomes intoxicated, and in that state is surrounded by a dancing multitude who score his body until the blood flows freely.

The use of intoxicants in pubertal rites is very common, especially among the American Indians. The Tuscaroras[1] of North Carolina, among other initiatory ordeals for boys, administered to them several kinds of barks and stimulating plants which produced a state of intoxication. When the Creek[2] boys were to be initiated into manhood they gathered two handfuls of a certain plant "which intoxicates and maddens," and continued eating the bitter root for a whole day, and then steeped the leaves in water and drank from this decoction.

Marriage, aside from being among savage people an occasion of general festivity in which intoxication adds to the excitement, is also marked by special ceremonies in which fermented drinks play an important part.

Death is also celebrated by intoxication. Featherman says of the Lapps[3] that when a man is dying the friends gather around the bed in order to assist the passage of the soul into the next world. They drink brandy in order to produce an artificial excitement which causes them to weep. Funerals, as well as weddings, often close in general intoxication. Among the Urabas, of Nicaragua,[4] when a chief dies ceremonies are held around the grave for two days, carried on amid the excitement produced by intoxication. Among other tribes the dead are remembered by annual drinking festivals.

Social. To give a complete account of the relations of intoxicants to the social life of primitive man would be almost to give a complete account of the social life itself.

The American Indians furnish an example of the close connection of stimulants and narcotics with the very roots of the social consciousness. Although alcoholic drinks were used in many places on the North American continent, the great narcotic was tobacco, which, however, was used not for its soothing effect alone, but very frequently to cause violent intoxication. Its influence in the life and society of these peoples was very great. Abbott[5] says: "To know the history of tobacco, of the customs of smoking and the origin of the pipe would be

[1] Featherman: *op. cit.*, Vol. III, p. 128.
[2] Featherman: *op. cit.*, Vol. III, p. 161.
[3] Featherman: *op. cit.*, Vol. IV, p. 459.
[4] Featherman: *op. cit.*, Vol. IV, p. 459.
[5] Primitive Industry, p. 315.

to solve many of the most interesting problems of American ethnology."

Among some peoples drink ceremonies have taken on the importance of a state function. A very interesting example is that of the Seminoles[1] who prepared no intoxicating drink, but who indulged every morning in a tea known as the "black drink," a slightly exhilarating beverage, prepared in the public square for the whole community by a cook expressly charged with the duty. The taking of the black drink was considered a solemn act having both a religious and a military significance. Extraordinary powers were attributed to it. It was supposed to have a purifying effect upon their lives, and to efface from their minds all the wrongs they had unintentionally committed. It had the power of imparting courage to the warrior and of rendering him invincible; of binding ties of friendship and of exciting kindly feelings. They regarded it as a blessing upon them as a chosen people. A similar ceremony was performed by the inhabitants of the Tongas.[2] When they arose at break-of-day the higher classes met for a drinking bout, kava being served. The taking of kava was always attended with tedious ceremonial forms and the strictest observance of etiquette. The whole community generally assembled. The common people were considered merely as spectators. A kava party was regarded as an essential part of any state affair.

Among the Creeks the taking of war physic was of the nature of a state ceremonial.[3]

We can sum up the social aspects of drinking among primitive peoples by saying that every event in the community out of the daily routine, which brings the people together, is likely to be the occasion of intoxication.

Periodic drinking. One cannot help noticing on examining the anthropological literature that the drinking of primitive peoples has a tendency to be periodic. The statement is frequently met with that tribes who are usually sober and industrious, on occasions indulge to great excess. The examples, of which the following are typical, are very numerous.

"The amusements of the Guatamalans[4] are less common and varied than among the whites, and are generally reserved for special occasions when all indulge to excess. Reunions with dancing are the common form of these amusements. Drinking is inseparable from them, and they do not usually break up until all have attained the climax of their wishes, becoming helplessly drunk."

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[1] Featherman: *op. cit.*, Vol. III, p. 170.
[2] Featherman: *op. cit.*, Vol. II, p. 115.
[3] Featherman, *op. cit.*, Vol. III, p. 164.
[4] Featherman: *op. cit.*, Vol. III, p. 550.

"The Maricopas tribes of the Pueblos[1] indulge once a year in a drinking bout, which continues from one to two weeks.

"The Dyaks of Borneo[2] celebrate numerous festivals of a quasi-religious character. The head feast lasts four days and four nights and a general state of intoxication closes the solemn ceremony.

"The Pueblos[3] get drunk once a year, the revelry continuing for a week or two at a time. But it is also a universal custom among them to take regular turns, so that only one third of the party is supposed to indulge at once. The remainder are required to care for their stimulated comrades and prevent them from injuring each other or being injured by other tribes. Some of the Pueblos' dances end with bacchanalia in which not only general intoxication but promiscuous intercourse between the sexes is permitted.

"Once a year the Keres[4] have a grand drink feast and dance. They pass the night in indulgences of a most gross and sensual description."

"The Mosquitos[5] have drinking bouts which last for days. At this large numbers assist in draining the canoe full of liquor prepared for the occasion. Occasionally, surrounding villages are invited and a drinking bout is held, first in one house then in another, until the climax is reached in a debauch by both sexes of the most revolting character."

"The Gonds[6] of the central provinces of Hindostan are of an unsteady temperament. They are industrious and work laboriously for a time, but during certain intervals of repose they abandon themselves to unrestrained dissipation, and squander the scanty gains they have earned. They believe that they have divine permission to sing, laugh and drink according to their hearts' content."

The statement that has often been made that no tribe has existed without its stimulant or narcotic, probably cannot be substantiated. It is true, however, that there is no large area of the earth's surface without its intoxicant. E. H. Man[7] says that in the Bay of Bengal, prior to the advent of the whites, the natives were ignorant of narcotics in any form. The Fuegians are said to have no intoxicating drinks of any kind, confining themselves exclusively to water. Several nations of American Indians, among them the Hurons, Chinooks, California Indians,

[1] Featherman: *op. cit.*, Vol. II, p. 279.
[2] Featherman: *op. cit.*, Vol. II, p. 350.
[3] Bancroft: Native Races, Vol. I, p. 550.
[4] Bancroft: *op. cit.*, Vol. I, p. 551.
[5] Bancroft: *op. cit.*, Vol. I, p. 706.
[6] Featherman: *op. cit.*, Vol.IV, p. 115.
[7] Andaman Islanders, p. 44.

the Shoshones, the Natchez and the Seminoles are all credited by either Bancroft or Featherman with an ignorance of alcohol in any form. Some tribes of Indians on the river Ariare, in New Granada, South America, are said not only to have no intoxicant of their own, but to refuse the stimulants of the whites.

Temperance. Primitive man was not wholly devoid of ideas of temperance. Certainly among the historical relics of the early civilizations frequent reference is made to the evils of drinking to excess. Laws were enacted and punishment inflicted for excess in drinking among many peoples. The worshippers of soma thought that all other liquors caused evil effects, and therefore prohibited them. Drinking is prohibited to women and lower classes among many peoples. One form of intoxicant is sometimes allowed to one class, while other classes use a different drink. Spencer thinks that temperance arose as self-control in order to offer libations to the gods. Though the idea of temperance may have originated partly in this practice, there is no reason to believe that this was the most important cause. Other factors enter, such as observation of its evil effects. The difference in the drinking of man and woman doubtless had an origin largely in the differences of mental activity in the two sexes. Later, no doubt, an increasing consciousness of, and respect for, the self was a cause of restraint (probably a very strong psychological motive for temperance at the present time). An increasing interest in general self-control as an ideal is probably the most potent factor of all in the development of temperance.[1]

Conclusions. Among primitive peoples, the use of intoxicants, although not quite universal, is so general, that exceptions are noteworthy. Intoxication seems to have originated in connection with the religious and social consciousness. Probably the use of fermented drinks originated in this way, and the use of them as beverages came at a later stage. A rather careful examination of the anthropological literature leads to the conclusion that taste was not much concerned at first. On the whole, primitive man is not a steady nor habitual drinker. He drinks alcohol occasionally to secure intoxication, his drinking is likely to be periodic, and in general it is characterized by great excess and uncontrolled excitement.

Intoxication in early civilizations. The history of intoxication among the civilized nations has for the most part been sufficiently treated by others. The best account is to be found in Samuelson's "History of Drink," and reference is made to that work.

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[1] See § 8.

Samuelson says that in every nation there was a period just previous to the time of highest culture when intoxication was exceedingly prevalent, and that again in the degenerate days after the highest point of culture was past there was a second period very similar to the first. In China there was an early period of gross intemperance. Mensius, a disciple of Confucius (about 500 B. C.), mentions drunkenness and speaks of the excessive use of wine in the sacrifices. But this appears not to have been a very frequent sin in his day. Long before that, however, the Shooking or history and the Sheeking or book of ancient poetry speak of an edict against drunkenness said to have been promulgated about 1100 B. C. It seems that drunkenness had taken such a hold upon the people as to threaten the ruin of the nation. In India, also, there was a period of great prevalence of intoxication, for the soma and sura play a very important part in the history of the early period. It is evident, also, that at one time drunkenness was not looked upon with disfavor for Indra was believed not to be capable of any great deed unless he was intoxicated.

Among the western nations Greece affords, in the worship of Dionysus, the best example of a religious cult growing out of the intoxication impulse. In its earliest form the Dionysiac worship appears to have been merely dancing and singing around the altar of the god, accompanied by intoxication; but with all the revelry there was an air of solemnity and reverence. It was later that there came to be in connection with this worship nude and sometimes indecent processions. In these the spirit was one of abandonment; slaves were given brief liberty and general drunkenness prevailed; Bacchus was represented, accompanied by women frenzied with drink or excitement carrying cymbals, dancing, and singing songs in honor of the god. In one of the celebrations performers, women and girls called Mænades, took part; orgies were held at night in the mountains; there were blazing torches and the wildest excitement prevailed.

The cult and symbolism of Dionysus have been variously interpreted. Nietzsche[1] says that the Greek conception of Dionysus was as the key to the mystery of life. The fundamental Greek instinct was revealed there. The meaning was the triumphant affirmation of life over death and change. Nietzsche finds also a very close relationship between sex and intoxication. Taylor's explanation of the Bacchic and Eleusinian mysteries is based upon its symbolism.[2] "They were considered for

[1] This and the following abstracts from Nietzsche are from Ellis: Affirmations.

[2] Taylor: Eleusinian and Bacchic Mysteries.

two thousand years or more," he says, "the appointed means of regeneration through an interior union with the divine essence. They were symbolic of the death of the old life and the birth of the new. The lesser mysteries occultly signified the miseries of the soul while in subjection to the body, the greater obscurely intimated by mystic and splendid visions the felicity of the soul here and hereafter when elevated to the realities of intellectual vision." The symbolism here signifies a higher consciousness and a more abundant life.

Whether a merely noetic explanation is sufficient to account for the form of these rites, they certainly originated in the emotions, and it is equally certain that pessimism and a craving for relief of pain were not the motives. Nietzsche touches the right key when he says that the Dionysia expressed a fundamental instinct of the Greek life. Music, the dance, intoxication, revelry, all united here under the guise of religious fervor to express the natural exuberance of life which was characteristic of this civilization.

Their poetry expresses this deep feeling element in no uncertain tones. Farnell[1] says that the dithyramb began here in the wild ecstatic song sung by wine-flushed revellers. Mure[2] expresses the same view when he says that everything leads to the belief that the proper characteristic of the Bacchic dithyramb, especially as remodeled by Arion, was like that of the god and his worshippers an exuberance of jovial excitement. Nietzsche discovers here, also, the origin of Greek art in two impulses, one starting in the phenomenon of dreaming, which he associates with Apollo, and the other starting in the phenomenon of intoxication associated with Dionysus. Tragedy is the outcome of Dionysiac music fertilized by Appoloniac imagery. Perhaps at no time in history has the inner growth force been so well exemplified and so fervently worshipped as in the early period of Greek civilization. The spirit of intoxication, as it was expressed in the Dionysiac cult, was one form in which the growth-impulse found vent in consciousness. The feeling which is expressed is a craving 'for life and for life more abundant.'

Intoxication among animals. Animal psychology has little to offer in the way of facts which bear upon the subject of the intoxication impulse, and the few facts which are well authenticated are difficult of interpretation, especially those in regard to the habitual use of alcoholic drinks by animals. Apparently animals are affected by alcohol in much the same way as men

[1] Farnell: Greek Lyric Poetry, p. 102.
[2] Mure: Critical History of the Language and Literature of Ancient Greece, Vol. III, p. 88.

are. Romanes[1] made experiments upon jellyfish, starfish and sea-urchins. The first effect upon Sarsia is to cause a great increase in the rapidity of swimming movements, so much so that the bell has no time to expand properly between the occurrences of the successive systoles. These motions gradually die out, and finally the animal is no longer responsive to stimuli applied to the tentacles. As to how the animal feels, whether he enjoys this experience and desires to repeat it, probably no one would venture to say. Dogs under the influence of large doses of alcohol show signs of apparent exaltation, in which motor activity and expressions of social feeling are increased, followed by stages in which there is depression and fear, and the animal skulks away and hides. Wasps have been observed in a state of intoxication after attacking over-ripe fruits. They get very drunk, crawl away in a semi-somnolent condition and repose in the grass until they recover, and then go to the fruit again. When thus affected they are said to do their worst stinging. Stories are told of elephants, apes, and dogs which have acquired a taste for alcoholic liquors. The fox terrier, a favorite among sailors, is often credited with a craving for alcohol. But in general such stories lack corroboration and there is always uncertainty as to the psychological interpretation of the facts. There is no doubt that dogs can be trained to drink beverages which contain alcohol, perhaps to like them; but it is impossible to determine in any case whether taste is all that is involved, or whether the animal is capable of forming such a complex association as to like a drink which is disagreeable in taste for the sake of a remote psychic effect, which is certainly the case with the human subject. Darwin[2] relates cases of baboons being made drunk with beer. The next morning the keeper found them holding their heads tightly, but when offered beer they refused to taste it again. One is tempted to say at first thought that the baboons remembered their disagreeable experiences, and objected to repeating them. But a more probable explanation is that they had a sensation of nausea, at the sight or smell of alcohol. Perhaps they would have refused food also. Dogs will readily drink sour beer and become intoxicated. Hens and chickens will devour eagerly bread soaked in whiskey or brandy. There are stories about dogs which prefer beer to meat. In the first two cases we cannot assume anything except taste, in the case of the dogs we cannot assume that, for there is another factor—training. Dr. Hodge's dogs have never shown a taste for alcohol during more than a two years' course of experiments, in which it was given

[1] Romanes: Jellyfish, Starfish and Sea-urchin, p. 227.
[2] Darwin: The Descent of Man, p. 7.

to them daily in rather large doses. One of these dogs after scenting a bottle of alcohol retired to a corner and refused to come when called again. This was after the two years' course of experiments. In her case, however, the dose had never been sufficient to cause intoxication.

So far as these facts go there is no evidence that animals learn to appreciate the state of intoxication or acquire a craving for alcohol. Although the matter is open to definite experiment, facts, even if obtained experimentally, would be difficult to interpret.

§ 3. The State of Intoxication.

Comparative effects of intoxicants. The drugs which are commonly used for intoxication purposes, though differing greatly in chemical composition, can be grouped into a single class, when they are studied with reference to their physiological effect. They are all stimulant-narcotics (Anstie), that is to say, when taken in small doses, or as an initial effect of large doses, they stimulate the nerve cells. Large doses invariably produce narcosis. It is true of most, if not all of these drugs, that, whether applied to a single nerve fibre, or to the nervous system as a whole by way of the circulation, they produce first a stage of increased excitability followed by a stage of lessened excitability. The mental effects are analogous—a stage of exhilaration is followed by a stage of depression.

A still wider generalization may be made. All poisonous substances which finally destroy the nervous tissue cause an initial stage of increased excitability. But, inasmuch as we have at the outset restricted the discussion in this paper to the psychological aspects of the subject, it is unnecessary to more than refer to the physiological problems involved. There has been much discussion as to the nature of the physiological and chemical processes of stimulation[1] and excitation, but little is surely known. The synonymous use of the two words has added much to the confusion. It is probable that there is a wide difference between increase of normal function, and increased excitability or irritation which may be regarded as an expression of the active resistance of the nerve cell to a poison,

[1] Stimulation, according to Anstie, is an increase in the *normal* functions of the nerve cell. Narcosis is paralysis of these functions. Most of the phenomena of excitement which occur in intoxication he says, are due to narcosis and not to stimulation. Many writers at the present time would deny that alcohol ever exerts a stimulating effect, in the sense of the word as used by Anstie, but class all its effects under the general head of narcosis or paralysis.

For a full account up to its date, see Anstie: "Stimulants and Narcotics;" also the works on materia medica and therapeutics, *e. g.*, Wood, Brunton; also standard works on poisons.

or even as a stage of paralysis. The physiological changes in the different stages of intoxication are quite unknown. Some think that paralysis of controlling brain cells can account for the increased mental activity; others think that the effect is upon the cells directly involved in the activity.

There are many interesting but for the most part popular accounts of the mental effects of the stimulant-narcotics. De-Quincey's "Confessions of an English Opium Eater" set the style for much of the literary treatment of the subject, and also popularized the use of drugs among writers for the purpose of exciting the imagination. Although in all these accounts some allowance must be made for exaggeration, their points of general agreement must be given due credit. There have also been made a considerable number of experimental studies upon intoxication which are of interest to psychology. Weir-Mitchell, Prentiss and Morgan, Delabarre, and others, have recently done experimental work with drugs.

It is the common testimony that in drug intoxication, the normal limits of both pleasure and pain are passed. Delabarre[1] says, that, as an effect of hasheesh one gets a larger idea of the range of the emotional life. The various forms of intoxication are nearly, if not quite always a succession of emotional changes, in which exhilaration accompanied by a free flow of thoughts, is followed by depression and decreased associational power. Frequently mentioned effects of drugs are the awakening of early memories, exaggeration of emotional states, changes in time and space perceptions commonly referred to as a "feeling of infinity," fantastic color visions, confusion of hearing and vision, animistic beliefs, philosophic insight, double personality, sensations of extension of the body, increase of personality.[2]

Experiments with intoxicating doses of alcohol. Experiments which were made by the present writer upon four subjects with intoxicating doses of alcohol, show that until the intoxication is well advanced the rapidity of simple mental processes was not greatly decreased. Adding, the memory of nine place figures, rapidity of tapping, strength of hand clasp, estimation of distance and of time, clearness of vision, were not seriously interfered with until muscular inco-ordination became extreme. The rapidity of tapping was most affected. Ability to control a reflex wink was greatly increased by the alcohol. A study was made also of the effect of intoxicating doses of alcohol upon the association of ideas. A list of 400 words was given to the subjects once on a normal day and then again two weeks later,

[1] Paper read before the American Psychological Association, New York, 1898.

[2] These statements are summarized from 60 cases gathered from the literature.

during the stages of a progressive intoxication. A single reaction to each word was required and the time was not taken. Comparing the two series of normal and alcohol reactions it appears that in the case of each subject there was a progressive dissimilarity in the two series which reached a maximum and then decreased as the effects of the alcohol passed off. The most noticeable change in association was the increase in the egoistic associations due to the alcohol. In one case the visual associations were increased. The chief effect upon consciousness was a succession of changes in the emotional tone. In all cases a stage of exhilaration was followed by a stage of depression and melancholy which in turn gave way to the normal condition. In two cases a second stage of exaltation followed the melancholy stage, but this was not so clearly marked as the first period. The emotional changes seemed to dominate the changes in the character of the associations. In each case there was a very clearly marked moment in which there was a feeling that control was being lost, accompanied by a desire to throw off all restraint and give way to the feelings.

In regard to the theory that the nerve cells are affected by alcohol inversely to the order of the acquirement of their function, our data rather confirm than contradict the statement, so far as it relates to motor development. Ribot[1] states this view somewhat as follows: 'At first there is an excitement, the very antithesis of reflection. Attention as a result of a motor convergence can no longer exist. Next the control of the tongue is lost. A man tells all his secrets; the will under the higher inhibitory form has disappeared. After this he becomes incapable of any continuous plan of action. Then the will, even under its lowest or most impulsive form, becomes powerless. Then the most delicate voluntary movements, those of speech and of the hands, cease to be co-ordinated. One degree lower he loses the semi-automatic movements, those of walking; then muscular tonicity weakens, he falls from his seat; then reflex movements are abolished, finally there is a cessation of automatic movements, those of respiration and of the heart.'

Conclusion. Examination of the literature of intoxication, and the experiments show that the pleasure of the state is due in part to the wide range of emotional tone. The changes in association appear to be dominated by changes in the emotions, the physical bases of which changes are quite unknown. For the present purposes, however, it is unnecessary to know their nature. The experiment upon the reflex wink, and common observation, both show that the feeling of personal safety is increased in the pleasure stage of intoxication. The falling

[1] Psychology of the Emotions, p. 424.

away of the sense of propriety which occurs in intoxication is illustrated by one of the cases studied. During the first two rounds of tests the subject (who is naturally very careful) was very exact in observing all the conditions of the experiment. In the later tests he showed an increasing carelessness and confidence. The psychological changes show an increased activity in those sensations, emotions, and associations which make up the self. The increased social feeling evidently depends upon these changes and is secondary. This is borne out by popular testimony as, for example, that those exhilarated by alcohol are better talkers than listeners. The two important conditions of social comfort are self-confidence, and (perhaps as a result of this) freedom from suspicions in regard to others. These factors differ greatly among individuals, and in the same individual they are subject to fluctuations due to physiological and other conditions. Just how alcohol produces these psychical conditions, whether by removal of certain recently acquired associations, or entirely by more general changes in the emotional tone, it is quite impossible to determine. The intimate relation of intoxication to the social impulse undoubtedly accounts in part, at least, for the widespread and persistent use of intoxicants, especially among primitive peoples. Doubtless it made possible wider social relations than could otherwise have been maintained in many cases where suspiciousness due to manner of life or to temperament tended to prevent free social life.

§ 4. A Study of Cases of Inebriety.

People who use alcoholic drinks to excess may be divided into two classes, dipsomaniacs and drunkards. The former are periodic drinkers, and true dipsomania is now generally recognized to be an indication of some form of nervous disease. The drunkard is the steady drinker, who, in general, drinks whenever he has opportunity, but drunkenness may take the form of sprees without becoming a true dipsomania. A study of various classifications of drinkers discloses the fact that there are two general types of organization which predispose to drunkenness. One is the undeveloped type, intellectually, morally, and physically of a low order. It represents a low stage of culture in which habit and ideals do not clash. The second is the degenerated type. People of this type commonly possess the craving for intensity of consciousness, which goes with culture and high ideals, but lack balance. To this class belong many men of genius who seem to crave strong excitement. But, applied to individual cases, such generalizations are unsatisfactory, and there is no more perplexing problem in individual psychology and physiology than is presented by the subtle dif-

ferences of organization, which make it possible for one man to drink moderately, without danger, while another, apparently as well constituted and as favorably conditioned, perishes in the presence of alcohol.

Dipsomania is full of interest to psychology. On the mental side it is a recurrent impulse to become intoxicated. During the intervals there is no desire for alcohol, and usually aversion. Its rhythms are especially interesting. Howard says that he believes the long rhythms in nutrition and heat regulations of the body are factors in augmenting and aggravating the periodicity of dipsomania. Monthly rhythms of the female are often accompanied by attacks of dipsomania. The season of the year seems also to exert a minor influence in inebriety. Crothers says that inebriety is more marked and more impulsive in the spring and early summer months. In a thousand cases of inebriety ninety-four drank to excess in April, May and June, and at no other time of the year.[1] In women the commencement of dipsomania very often dates from menstrual disturbances, from pregnancy, and from the menopause. The attacks of dipsomania are usually preceded by disturbed mental action and control. Before an attack the dipsomaniac is irritable, and there are other signs of nervous disturbance. When alcohol cannot be obtained there is restlessness, indefinable horror as of some impending danger, the throat is parched, the skin hot and dry, the pulse rate is increased.

These are the main facts of dipsomania. For more extended accounts reference must be made to the psychiatrical treatises, such as the works of Krafft-Ebing, Kräpelin and others. Also to numerous articles in the *Journal of Inebriety*.

Below are given extracts from sixty-five cases of inebriety, studied by the present writer largely to determine the nature of the craving for intoxicants as it is felt by the inebriate. Most of the men studied were confined in criminal institutions. A few were voluntary patients in inebriate asylums. For the most part the conversational language of the subject is retained.

Case 1. Man, 25. Drank since 15. Used a quart of whiskey a day for years. Has drunk alone, but generally likes to drink in a crowd. No craving for it at all while in jail.

Case 2. Man, 31. Drank his first glass at 24. Drinks socially altogether. Is drunk every Saturday night. No craving for drink now or during the week when he is out. When tired and thirsty one glass of beer tastes good. After that it is not the taste. He drinks for the feeling, or because he has lost control, and does not care what he does. Afterwards feels the disgrace keenly. He is strong, of athletic build, and in perfect health so far as he knows.

Case 3. Man, 36. Always drinks in company. Never intends to get

[1] Crothers: The Influence of the Seasons on Inebriety, *Quarterly Journal of Inebriety*, July, 1897, Vol. XIX, pp. 315-316.

drunk when he starts. Occasionally between drunks will take a glass of beer. Trouble will always make him get drunk. When in jail feels the loss of his pipe, but does not feel the loss of his drink. As a boy, was very bashful. Would always take a few drinks before going to a party or social.

Case 4. Man, 38. Been drinking since 16. Very seldom drinks alone. Has no appetite for it here, and does n't see why it can't be the same outside. If he succeeds in going two or three weeks without drinking, he does not crave for it.

Case 5. Man, 52. Been drinking since 16. For the last few years has drunk very heavily. Drinks mostly in company. Drinks because he worries. Has n't missed liquor at all since he came here. Misses his tobacco some. Is of a nervous temperament, always was nervous. Thinks he is not going to drink any more.

Case 6. Man, 21. Been drinking since 14. Has drunk alone a good deal. Likes to be alone when drinking. Has drunk as many as thirty glasses a day. Had been drinking heavily when arrested, but missed the liquor for two or three days only. Takes more to make him drunk than when he began drinking.

Case 7. Man, 43. Been drinking since 20. If he takes one drink is sure to take another. Does n't like the taste of beer nor liquor. It is for the feeling after it is down. If there was no rum, would never have any longing for it.

Case 8. Man, 32. Very hard drinker. Does n't care for the taste of liquor at all. Does n't care anything about it until he gets into company. Never goes into a saloon alone. If worried about anything goes out looking for company, and drinks. In jail, does n't crave either liquor or smoking. But does crave chewing tobacco.

Case 9. Man, 43. Of melancholy temperament. His drinking is periodic. Always drinks alone. When he drinks with a crowd, he spends too much money. Will go for two or three months and have no desire for it at all. Went a year without touching it. Is quite sure he is never going to drink any more.

Case 10. Man, 50. Been drinking since 16. Has never had any craving for drink. Never thinks of it when in jail. Does not like the taste of whiskey or beer, or any other kind of liquor. Never goes in to drink alone, even when he has money. He never goes in because he wants a drink.

Case 11. Man, 48. Been drinking since 19. Does n't like liquor. Never goes in to get a drink by himself. Drinks by sprees. When he meets two or three old friends, he likes to go in and talk over old times, and thus gets drinking and can't stop. Misses the tobacco more than rum. A man does n't need rum, he does need tobacco. Is sure he is not going to drink any more.

Case 12. Man, 43. Been drinking since 25. Does n't like the taste of liquor. No craving for it, now or ever. But cannot take a glass or two and then stop. Always gets drunk when he drinks at all. His health is good and he is not nervous.

Case 13. Man, 40. Drinking since 17. At 30, commenced to use whiskey altogether. Always drank alone and every day. His usual allowance was fifteen or twenty glasses in a day. Four years ago he stopped for a year after taking a six weeks' treatment. Has no craving for alcohol now whatever, but there is a struggle all the time against depression and fatigue. If he has n't had anything to drink for a month or two, he does not crave it at all.

Case 14. Man, 18. Never likes the taste of liquor, except after he has been drinking heavily. For three or four weeks after coming to jail he craved both liquor and tobacco. Now he does not think of either.

Case 15. Man, 36. A sailor. Drinks nothing when at sea. Misses

it the first two or three days out. Since he has been in jail has missed his pipe, but does n't care for drink. He never drinks alone. Does n't like the taste of liquor, it is the sensation.

Case 16. Man, 35. First drink at 14. The only craving is on a hot day when thirsty, then he really feels a craving for a glass of beer. It is impossible for him to drink moderately now. When he drinks he always drinks too much. When he has n't had a drink, he does n't want it. When he has, he wants more. Is in perfect health, so far as he knows.

Case 17. Man, 24. Does n't like the taste of whiskey nor crave it, but when he once takes a taste of it, can't stop short of extreme intoxication. Is never tempted to drink except when out with the boys.

Case 18. Man, 26. Has been drinking since 20. After he has had one drink, he has a strong craving for more. Otherwise he has no taste for it whatever, and never thinks of it except when he is where there is excitement and drinking is going on. To have a good time is the starting.

Case 32. Man, 23. Has no craving for liquor. Once in a while drinks alone, but never intentionally to get drunk. Likes the taste of whiskey. When with a crowd, does not feel as if he was having a good time unless he drinks. If he takes one drink, he always gets drunk.

In fifty-eight of the sixty-five cases studied, there is no evidence of a conscious craving for alcohol, although most of the men who were questioned are confirmed drunkards. Nearly all are recidivists. One has been sentenced sixteen times for drunkenness. The statement that after liquor has been for any reason cut off for a period of from ten to twenty days the craving ceases is so frequent in these cases that it must be regarded as expressing the true mental attitude toward drink of a class of people who are commonly considered incurable drunkards. In the six cases which follow there was some evidence of a craving for alcohol.

Case 19. Man, 49. Unmarried. No nervous disease or insanity in the family, so far as he knows. His father died at 76, of old age; mother at 50, of pneumonia. He has six brothers and sisters, none of whom drink. He, himself, has always been healthy. Left school at 14, was a good boy, always went to church at that time. His first drink was taken at 16. Used to set up ten-pins in a bowling alley. Drank beer there, drank beer altogether for a long time, before he began to use stronger drinks. Never drank for the taste. In general, his drinking has been to create a false spirit when he is down-hearted. He has never been in the habit of drinking daily; for years, his drinking has been by sprees. Between drunks he would not drink at all; has tried very hard to overcome the habit. Thought it was wrong and that it was hurting him. Would fight it for five or six days, but sooner or later would get in with the boys. Of late years he has drunk alone mostly. Went without drink altogether for two years, from 1876-78. At that time was working for good pay and simply made up his mind to stop drinking and succeeded.

Every month for the last seven years, he has spent two days drinking, and three days recovering from it. In this he has been perfectly regular. He has taken asylum treatment to no avail. Although, during all these four years, he has never once missed a week's drunk, he thinks that if there had been no way of obtaining liquor, he never

would have craved it. He has no craving for it now at all, and does n't even think of it. But when he was working, every Saturday he would think of it all the afternoon, would go home in the evening, change his clothes and go down town. He would walk around until about eight o'clock, and then would go in and get a glass of beer; that would be the beginning of drinking, which would be kept up steadily until Tuesday. He knows of no cause for his drinking, cannot in any way explain the impulse, which is entirely beyond his control. Never left the shop Saturday without fully intending to stay sober. Each time determines never to touch another drop. He feels that there is some peculiar weakness of his nature, and thinks that even in the absence of liquor, he would have found some other way to ruin himself. Again he says that he feels quite convinced that he is never going to drink any more. As a child, he was restless and uneasy, of vivid imagination, quick tempered, but honest and truthful. Never cared much for society of the other sex.

Case 20. Man, 38. Only child. Father living, now 80. A periodical drinker. At 11 was made drunk, was taken home by two men. Does n't remember feeling sorry about it. As a child was very nervous and high strung. He has been a periodic drinker since he was 17. At 32 he broke his leg, and at that time began to use morphine to kill the pain. Has used it ever since. Morphine makes him feel dull; it is quite different with alcohol. A little makes him thrill all over. The least taste of alcohol will set him going, even sweet cider, unless it is just out of the press. Morphine he uses now after he has been drinking heavily. It sobers him, makes him fall asleep, and puts an end to his spree. His periods are usually precipitated by meeting a friend. Meeting an old comrade affects him in a manner which he cannot explain. He is inclined to be very intense, both in his likes and dislikes. He hates the taste of drink of all kinds. His periods come now at intervals of from three months to a year. He went once two years without drinking. Many times he can control the impulse, but is very easily and strangely influenced. He feels that he will control his appetite altogether sometime, but expects another attack when he gets out this time. He thinks he is safest when he is where liquour can readily be obtained; when away where he can't get it, there is likely to be an increasing craving. Periods are most likely to come on at times when he is despondent or depressed. He is by nature of an unstable disposition, loves frequent change, has worked at almost every trade. As a boy he had plenty of money, a good education, and never expected to have to earn his living. He feels keenly the disgrace of his condition.

Case 21. Man, 34. An actor. Good health, no nervous disorders. His first drink was at 12. Was out skating on a cold night and drank cherry brandy. His next drink was taken at 17. He was working in a bank, came down town too late for breakfast, ordered a glass of beer. He was alone. After this he drank more or less, socially. He was occasionally drunk, but only at times of unusual festivity, as at New Year's Day and the like. Was married at 21. From 21–27, drank rather steadily, but only in a social way. At 27 he parted with his wife. After that he drank to excess in order to forget. Drank alone altogether, and continually. Rented a room and began a spree which lasted for six months. During that time there was not a day that he was sober. Since then his drinking has been somewhat periodical. Went West to work on a ranch, and went eight months without liquor. He was where he could not get it conveniently and had no craving for it. Was offered drink a few times during that period, but refused. Lately, his sprees have been more frequent. Sometimes he can go for weeks and drink more or less moderately, but invariably ends in an

uncontrollable spree. In 1893 he spent four weeks at the Keeley Cure, from that time to February 1896, he went without drink. His sprees always last as long as he has money or can get whiskey. As regards the craving, when he has n't been drinking, he does n't crave liquor, but when he has once started, the need is imperative. He has no craving since he came to the inebriates' home, although he has not been under restraint. Thinks that if he lived all the time in such an environment, he never would think of liquor. The craving is more of a mental than a physical craving. It is a desire to get away from himself. The craving for drink is a craving which any other pleasure equal in degree would satisfy. It is a disgust with present conditions and a desire to cut loose from old ruts and have a change. Of late his sprees have always been preceded by a fit of despondency. Looking back, he can trace two quite different conditions, which are likely to initiate a period of drinking: one is depression, and the other is unusual success. The nature of his mental condition during a spree differs greatly according to the mood in which it starts. If he starts in a happy mood, he is jovial all the time; if he starts drinking when he is depressed, he is unsocial and silent, and there is no stage of exhilaration. He does not feel at all sure that he is cured. One might as well ask him whether he ever intended to have pneumonia again. It is a thing which he does not control.

Case 22. Man, 45. Father died at 65 of kidney trouble. Mother living at 70. One brother and one sister, both died young. Was 17 when he took his first drink: it was at a wedding. After that drank steadily, and his drinking was periodical from the start, his sprees occurring at intervals of from three to six months. The longest interval was a year and a half, when he was 38. At that time he was a member of a reform club. During all that time he never had any craving for liquor whatever. Excitement and association broke the spell. His periods are induced usually by associating with people who drink, or by misfortune, or anger. He does not like the taste of alcohol nor crave it. But if he gets to drinking cannot stop. He has been arrested eight or ten times, each time for drinking. When drunk he is peaceable and jolly. He never drinks alone. Probably never drank 25 drinks alone in his life. He never cares for drink unless there is excitement, and there is no excitement when a man is alone. Says he cannot remember a day in jail when he ever wanted a drink. He craves tobacco, however, and gets so nervous craving for it that he could almost chew iron. He does n't feel sure that his drinking is permanently stopped. He thinks confinement has no effect, for a man can't be cured by loneliness, the only way is to keep him away from drinking society.

Case 23. Man, 38. Born in Ireland. For the last 28 years he has been drunk about once a week. When he is out of jail has a craving for drink, it is like a gnawing in the stomach, as though he wanted something to eat. Is thinking of it all the time until he gets a drink. Never thinks of it at all when he is in jail. Tobacco he craves. Would think of the whiskey, too, probably, if there was any chance of getting it. It is the thought of it which puts the appetite down into the stomach. Has taken the pledge a good many times, and kept it once a year and a half, fifteen years ago.

Case 24. Man, 40. Is nervous, weak and emaciated. Suffers from insomnia. Says that he does n't know of any worse drunkard than he is. Left school at 15, first drink at 18, was out with a crowd of boys and took two glasses of beer. Has never been able from the very start to drink moderately. Still he thinks he has no craving for it when he has not been drinking. Never cares for it when alone except after drinking, then he would walk five miles to get it. Managed to stop for a few months once, but got out with the boys again; thought that

he could drink moderately, but was soon as bad as ever. His sprees usually last until he gets out of money, sometimes he drinks almost continuously for two weeks. Never thinks of the liquor when he is in jail, craves more for the tobacco. Thinks he has been getting worse lately; the excitement and exhilaration after drinking is less, he seems soon to lose his mind and can remember but little afterwards. He has frequently signed pledges, and once or twice has gone three or four months without drinking. Means to do right, has sworn time and time again never to drink any more. The craving for liquor, as he feels it, is hard to describe. He recognizes it as a kind of hankering and worrying, it is entirely different from the craving a man has after he has been drinking. Since he has been in jail he has felt worried and depressed, but feels nothing which he can call a desire for liquor. Once when he had not been drinking for two months he came to the city on a holiday, and going by a saloon it seemed that he must go in and get a drink. The thought almost made him dizzy, felt as though he could not take any interest in anything, as though all the fun and excitement would be monotonous unless he had a drink to help him enjoy it; but he resisted the temptation, went into a restaurant and had dinner, and all the rest of the day he had no thought of drink. Sometimes when he has a craving for drink other things will satisfy him, as non-alcoholic beverages or a dinner, as in the case described above. The presence or odor of alcohol will not always arouse a craving. He has often been where there was plenty of it, and would have no desire for it, and could not be induced to touch it.

Case 25. Woman, 52. Periodical drinker for the last 17 years. The periods have usually come at intervals of from four to six weeks. She has been six months without drinking. Thinks she has been worse since she was 44. For the last four years and a half she has n't drunk at all, having been in voluntary confinement in an inebriates' home. She is not in any way under restraint. She goes out to church and on errands, and during the day works, serving the establishment in the capacity of cook. In appearance she is strong, well nourished, apparently of strong will, very intelligent. Has a deep religious sense, is extremely sensitive about her degradation and her menial position. Is at times unsocial, irritable and sarcastic. She still has the craving for alcohol, which is likely to come about once in a month. At those times she goes to the matron and asks to be watched. She thinks that she will have to fight this craving all her life. Her only physical ailments, so far as she knows, is slight dyspepsia and nervousness. If things go wrong the craving is likely to be more intense. At these times she feels as if she must hold herself to keep from going out to get a drink. At communion service the taste of unfermented wine makes her "mad" to drink the whole cup. The craving is not a thirst, and it is very different from the craving she used to have after drinking. Then she would tear everything to pieces to get a drink. Would walk from the battery to Harlem for it. Her craving, as nearly as she can analyze it, seems to be a longing made up of depression, increased sensitiveness to slights of all kinds, and a general nervous irritability.

The testimony of all the men who were questioned upon the subject goes to show that the craving for alcohol is a rather unimportant part of the intoxication impulse. As one expressed it, "the craving for alcohol is more than a desire to take a drink, it is the craving for something which accompanies it." With one or two exceptions the testimony is that after a man has been without drink for a few days (10 days is the

time mentioned in most cases), there is no longer a craving for alcohol. This is especially true when a man is so situated that liquor cannot be obtained. This testimony is emphatic, and there is no doubt whatever of its correctness as far as the introspection of the subjects will go. The testimony is equally as emphatic that for the first few days the craving is often intense, that there are physiological accompaniments, such as a general distress, burning in the throat or stomach, weakness and trembling. The usual reply, when a man was asked whether he felt the loss of liquor when it could not be obtained, was, "I never think of it," or "It never bothers me at all." On the other hand, the testimony is equally strong that tobacco is missed. There can be no doubt, whatever, of this difference of feeling. The change of expression of the face when tobacco is mentioned cannot be mistaken. Many say, "I think of it every day." As to the interpretation of these facts, a partial explanation of the difference is to be found in the fact that tobacco is sometimes obtained in jail and is secretly used. The thought that there is a possibility of obtaining it keeps alive the craving. Another reason is the fact that tobacco is not regarded as the cause of the disgrace and annoyance of imprisonment. Another cause, and in all probability the most potent of all, is the social condition of a man in prison. Tobacco is, perhaps, most enjoyably used when a man is alone and inactive. It is a solitary habit quite as often as a social habit, and the solitariness of prison life continually suggests the use of tobacco. The alcohol habit on the other hand is not a solitary habit in most cases. The conditions of prison life are unfavorable for keeping alive the desire for drink, which is in general an accompaniment of the social consciousness. It is certain at least that whatever longing or craving a drunkard in prison may have, it is not recognized by the man himself as a craving for alcohol. The only real conscious craving, so far as can be discovered, is in the neurotic cases. The clearest example of a craving for alcohol is case 25. In this case there is doubtless a nervous disturbance of some kind which is periodic, and which is interpreted as a craving for alcohol. This may be an erroneous judgment on the part of the subject. The strongly fixed belief, that there is indelibly stamped into her organism a craving for alcohol, no doubt tends to keep alive the craving. It is certainly nothing more than association, which makes her "mad" to drink all the unfermented wine at communion.

In other cases the effect of the popular belief in the organic nature of the alcohol habit, instilled into the mind of the drunkard by people who are trying to help him, is evident in making him lose hope, if it does not actually take away the possibility of cure.

Further evidence of the mental nature of the craving for drink is furnished by the cures. The conversion and moral cures are confessedly mental. They cure the craving for drink by changing the general life interest. Leuba[1] gives in detail several cases in which the drink craving was taken away instantly by conversion. From this article the following are quoted:

Man, 42. Converted when 33. Sometimes drunk for a week together. Then not a drop for a whole month. Never went more than a month but once, when he joined the Good Templars, when he went without drink for three months. He experienced sudden conversion. "From that hour," he says, "drink has had no terrors for me, I never touch it, never want it." Another says, "I believe that God took away the appetite for drink that night when I asked him. Man, 44. Converted in 1883. Had been a hard drinker. Made many resolutions, but could not keep them. Had a sudden sense of powerlessness, experienced conversion. Conversion took place on Sunday. "On Monday," he says, "there was no desire for drink." "Since that day I have not had to surmount strong temptations."

Two of my own cases show well the mental nature of the cures for intemperance.

Case 26. Man, 48. First drink at eighteen with a crowd. Became a settled habit at 28. Drank every day. Began on beer, and about 28 changed to heavier drinks. Would go two months drinking everything then stop for a week from physical incapacity to drink anything more. Drank to keep up an exhilaration so that he could do more work. Drank when he hated the taste of liquor, and could hardly get it down. But had to take it in order to appear right. Took more and more as time went on. Before he was 38 had tried to reform several times. Changed his residence, but it did no good. Always drank alone for the reason that he did n't want any one to know about it. Never stayed in a saloon longer than was necessary to get what he came for. When 44 he had been drinking very hard, and his wife made him promise to try to reform, urging him to become converted. He had always scoffed at the idea that change of heart would do it, but went to a clergyman and told him that he would sign the pledge for a year. The clergyman would not accept it, so he made out a life pledge and signed it. Gave his wife all the money he had except a very little, thinking that if nothing could cure him, he would buy some liquor. For a few days, after signing the pledge, he was terribly weak and unable to act. All the time there was a craving for liquor. He knew that it would put new life into him and make him act. The craving was settled in one day. It suddenly occurred to him that he was not more than half honest in the matter, so he went to his wife and gave her the rest of the money and confessed his intentions. As soon as he had done that, it seemed as if the craving was entirely changed and from that time on, until nearly three years after, he had no craving for alcohol. His health was good, worked at the hardest kind of work, chopping in the woods, and, so far as he knows, felt no effect of his hard drinking after the first two weeks. At the end of three years, when on a visit to a summer resort, he drank two glasses of cider. The next day he was as weak as ever. Found out that the weakness had not healed, became frightened, fearing that his drink habit would return, and started

[1] Leuba: A Study in the Psychology of Religious Phenomena. *Am. Jour. of Psychology*, April, '96, Vol. VII, No. 3, pp. 309-383, Appendix.

away in the rain to walk seven miles to the depot. When he reached the first house, he stopped and asked for a drink and got it. Got some more a little further on. This commenced a downfall more complete than the first. He has continued drinking up to the present time. Says that he has to have alcohol to keep him steady, and to make him think. If he goes a day without it, his nerves seem to be shattered. Thought he could n't add a column of figures unless he had his drink in the morning.[1] Has a craving for liquor which he cannot resist.

Case 27. Man, 44. Was through college at 18. Went to work in a bank. At 22 began to drink steadily, brandy and port wine being his favorite drinks. Drank for the taste of the liquor mostly. Belonged to clubs, and drank at socials. Soon began to use liquor to excess, and drank both for the taste and the feeling. It was steady drinking all the time. Drank in company altogether. Later, drank alone but never to get drunk alone. There was hardly a day that he did n't drink excessively, although he never went to extreme intoxication. The last two years of his drinking (from 42 to 44), did n't try much to control his appetite. Kept up his business, and used to do better work after he had three or four drinks. Was doing some literary and lecture work at the time. Always drank heavily before going to make a speech. Stopped drinking in April, 1894. Had been to a kind of a racket at a club, drank heavily all night. In the morning was walking around with three or four men. It suddenly occurred to him that he was living a useless life, told the men he was with that he was not going to drink any more. They laughed at him and told him that he could not stop. Drunk as he was, he sat down and made out an agreement not to drink any more from April 14 to July 4. This he agreed to sign if one of the others would. One agreed, so he signed the paper and handed it to the other man. The other one remarked that as long as he had the agreement, he guessed he would not sign it himself and put it into his pocket. This angered him and he made up his mind to keep the agreement, whether the other man did or not. Did not drink any more that day, left the men at four o'clock and went home sick. Went to a doctor who told him that he would have to stop by degrees, or it would kill him. But he refused to drink. After a week there was no craving and he refused liquor ten times a day for the next six months. He has never drunk since. Very frequently now he goes into a saloon with friends, but always calls for non-alcoholic drinks. The odor and sight of liquor do not arouse in him any craving. He has noticed that since he stopped drinking he cares less for the society of men and feels that in a way his social feeling is weakened.

In other cures the principle is psychic. Most of the inebriates' homes depend upon moral instruction and social environment. The principle of such a cure as the Keeley Cure is largely, if not altogether, mental. In the methods, which are used by regular practitioners, reliance is placed upon general tonics and moral influence. Other cures make use of substitutes which have an effect similar to alcohol. Emetics are given which create an association of nausea with the taste of alcohol.

The evidence from the cases indicate that the craving for drink is not a craving of childhood. In the few cases in which

[1] A series of tests on four consecutive days during which he took no alcohol, disproved this, however. He did better each day, and much better than when he was using alcohol. During his abstinent days he felt no craving for liquor because 'he knew he was not going to have any.'

the first drink was taken at nine or ten the real history of the case does not begin until some years later. In general, if our cases are typical, drinking does not begin during school life. In a great majority of cases the first drink was taken after the boy had left school and had begun to associate with older men. The beginning was almost always social. In but two instances was the first drink taken alone. There are one or two instances in which the first drink was taken after 40. In the latter cases alcohol was taken by a doctor's orders, and the habit thus formed was never broken. Below is given a table showing the age at which the first glass was taken in 65 cases.

Table showing when first drink was taken in 65 cases.

AGE.	NO. OF CASES.	AGE.	NO. OF CASES.	AGE.	NO. OF CASES.
9	1	20	6	31	0
10	1	21	1	32	0
11	1	22	5	33	0
12	2	23	0	34	1
13	0	24	1	35	1
14	5	25	3	36	0
15	6	26	2	37	0
16	10	27	2	38	0
17	8	28	0	39	1
18	5	29	0	40	1
19	1	30	1		

Below are tabulated 498 cases[1] of inebriety with reference to the time when the drinking habit was formed. This does not refer to the time when the first drink was taken, but when more or less regular drinking began.

By referring to the tables it will be noticed that among the 65 cases more took the first drink at 16 than at any other year. At 20 is the greatest tendency for drinking to become a habit.

Parrish[2] says that the drink craving does not declare itself until the demands upon the nervous system come to be exorbitant, and that its terminal period comes with as much certainty as does its initial stage. He thinks 'that there is an inebriate climacteric in every life, when nervous periodicities become faint, when internal and external excitants to intoxication lose much

[1] These cases are from statistics taken from Thomann's Real and Imaginary Effects of Intemperance.
[2] Alcohol Inebriety, 1883.

Table showing age at which drinking was commenced in 498 cases.

Age.	No. of Cases.		Age.	No. of Cases.		Age.	No. of Cases.		Age.	No. of Cases.	
	Males.	Fem.		Males.	Fem.		Males.	Fem.		Males.	Fem.
10	2	0	22	32	2	33	10	5	43	1	1
11	0	0	23	21	1	34	8	4	44	2	2
12	4	0	24	22	0	35	9	2	45	2	0
13	6	0	25	17	4	36	3	2	46	1	1
14	8	0	26	14	3	37	2	2	47	1	0
15	26	0	27	16	2	38	2	0	48	2	0
16	14	2	28	13	3	39	1	4	49	5	1
17	19	0	29	8	1	40	3	0	50	3	0
18	35	1	30	20	5	41	1	0	51	1	0
19	18	2	31	4	0	42	2	1	52	1	0
20	50	3	32	3	1				53	0	0
21	29	0							54	2	0

of their vigor, and the inebriate diathesis is too feeble to respond to excitation. Between forty and fifty a great number of spontaneous recoveries occur. Between fifteen and twenty-five most cases begin. About twenty-five years closes the drinking period, either by exhaustion of the desire, or by death.' Crothers[1] says 'that there are periods from seventeen to twenty-five and from thirty to forty in which the liability to contract the drink habit is greatest. This is most likely to die out between forty-five and fifty, or from fifty-eight to sixty-two. The physiological changes of mature life bring changes of nerve vigor and growth, periods closely corresponding to the evolutionary periods of women.' Superintendent Hadley, of the McCauley Mission in New York City, says that most conversions of drunkards take place between the ages of thirty and fifty. Dr. Braintwaite,[2] Superintendent of the Dalrymple Home in England, says that most of the cures take place between thirty and forty-five, though many cases do well older, up to fifty-five and sixty. The younger cases are most unsatisfactory. He says "very few, indeed, succeed in getting right under twenty-five or twenty-six." If the physiological basis of the drink craving is the change of protoplasm, due to the continued assaults of alcohol, as many maintain, it would be difficult to account for the fact that young men are, as a rule, less easily cured than older men.

From the data obtained from these cases we can simply enumerate the usual motives which lead to intoxication. For a quantitative estimation of these motives a much greater number of cases would be needed. They are as follows: (1) a desire for excitement, experience and abandon; to increase companionship, to put off reserve in the presence of others. (This desire to heighten the social feeling is probably the most prominent cause

[1] In correspondence.
[2] In correspondence.

of drinking. Many drunkards would regard it as a disgrace to drink in any other way than socially.) (2) To kill pain, to calm moral distress, to overcome fatigue, a desire for temporary relief from poverty or monotony; to increase courage or overcome self-consciousness, to steady the nerves for work or unusual strain.

Thus far we have found evidence to lead to the conclusion that the craving for alcohol, as felt by the drunkard, is not a specific craving, and that when the occasion of drinking is removed usually nothing remains of the craving as such, or it is so merged in other desires that it is not recognized by the subject. A drunkard is what he is because he enjoys a certain mental state, which is most conveniently induced by alcohol. This mental state is very closely associated with the social impulse. The moderate drinker, who never drinks to intoxication, belongs to quite a different class. He drinks, for the most part, because he likes the taste of alcoholic beverages.

§ 5. Effect of Intoxication upon the Literature and Language.

Intoxication, like all peculiar and abnormal mental states, is a subject of natural interest to primitive people, as is shown by the influence it has exerted upon the language and literature. In fairy tales intoxicants are often spoken of. The love potions and philters, elixirs and waters of life are often stimulants and narcotics, as well as aphrodisiacs. Of the gods of wine Dionysus of the Greeks and Indra of the Hindus are best known. Drunkenness was also honored by divinities among the ancient Mexicans.

Among primitive peoples the common element in the myths of wine is the belief in its divine origin. Intoxicants are believed to lift the soul up to a higher level, to bring it into touch with divine powers. Wine is often included among the pleasures of the next world.

The remarkable influence that intoxication has had upon the popular mind[1] is shown by the great number of synonyms for the state which have been in common use. No other thing except the sexual relationship has made a deeper impression upon the popular language. Below are given a few synonyms collected from the slang literature and other sources. No attempt was made to make the list even approximately complete. Some purely local expressions are included. Translations from German and French have been omitted.

[1] Ribot, quoting from Renan says, "a people have usually many words for what most interests them." (Evolution of General Ideas, p. 76.)

Most of these terms are expressions of contempt, having reference to the disabled stage of intoxication. A few, like inspired, electrified, jolly, glorious, exalted, refer to the stimulated stage.

Synonyms for Intoxication. A bit on, addled, off, all key holes, all mops and brooms, all sails set, a passenger in the Cape Ann stage, artificial, at rest.

Bacchi plenus, back teeth afloat, bamboozled, banged up to the eyes, battered, beastly, been among the Philistines, been at a ploughing match, been flying high, been hit by a barn mouse, been lapping the gutter, been in the sun, been rushing the growler, been sucking the can, been taking bitters, been taking tea, beery, bended, bitch fou', blowed, blind drunk, blowing, blued, blue eyed, boiling drunk, borey-eyed, boosey, breezy, brick in the hat, bright in the eye, bruised, budgy, buffy, bummy.

Canonized, can't say "National intelligence," can't see a hole in a ladder, caught a fox, caught favor, channels under, chirping merry, chuck full, clear, clinched, cocked, come from Liquor pond street, comfortable, concerned, corned, cosey, coxy-loxy, croaked, cronk, crooked, crook-in-the-elbow, crying drunk, cup-shot, cut.

Damaged, dazed, dead drunk, dipped deep, discouraged, disguised, done over, doped, down in the mouth, down with the barrel fever, drowning the shamrock, drunk, drunk and disorderly, drunk and dressed up, drunk as an ass, drunk as a biled owl, drunk as a brewer's horse, drunk as a drum, drunk as a fiddler, drunk as a fish, drunk as a fly, drunk as a Gassport fiddler, drunk as a lord, drunk as a mouse, drunk as an owl, drunk as a pipey, drunk as a tapster, drunk as a rat, drunk as a sow, drunk as a wheelbarrow, drunk as Bacchus, drunk as Chloe, drunk as he can hang together, dry, dull in the eye.

Edge on, electrified, elevated, exalted.

Faint, far gone, feeler on, feels good, feels his oats, feels right royal, feverish, filled to the brim, flag of defiance out, flatch kennurd, flawed, fluffy, flummoxed, flush, flushed, flustered, flusticated, fly blown, flying high, fogged, fogmatic, forward, fou', four sheets to the wind, fow, foxed, fresh, fuddled, full, full cocked, full of ballast, full of pots, full of rum, full to the brim, full to the bung, fuzed, fuzzy.

Gilded, gilded o'er, gilt edge on, glorious, google eyed, got a big head, got a bundle, got a drop in the eye, got a smile on, got the gravel rash, greetin fou', groatable, groggy, gutter legged, guzzled.

Had an eye opener, half and half, half cut, half on, half shot, happy, hard up, has n't got his sea legs, hazy, headed for port, head light on, head on, heady, hearty, helpless, high, high lonesome, hilarious, holds up the lamp post, hoodman, hot, how came ye so, how fare ye.

In a difficulty, in a very good humor, in his altitudes, in good fettle, in good spirits, in his cups, in liquor, inspired, in the blues, in the gutter, in the wind, intoxicated, irrigated, iskimmish.

Jagged up, jag on, jammed, jib well bowsed, jim jams (has the), jolly, joyful, jug-steamed.

Kisky.

Laid away, leary, leery, legs broke, limber, loaded, loaded for bears, loaded to the gunwales, load on, looking lively, loose, lumpy, lushed, lushy.

Main brace well spliced, making m's and w's, martin drunk, mawled, medza-beargeared, mellow, miraculous, moony, moppy, mortal, muddled, muggy.

Nazie, night cap on, not in a fit state for discussion.

Obfusticated, off his nut, on a blow out, on a bust, on a hurrah, on

a skate, on a spree, on a tear, on a triumphant, on his fourth, on the batter, on the beam end, on the beer, on the bend, on the fuddle, on the gay galoot, on the lee lurch, on the loose, on the muddle, on the nipple, on the rampage, on the ran-tan, on the re-raw, on the skyte, on the stuff, on the tiles, one sheet in the wind, ossified, out of funds, overcome, overstocked, over the bay.

Paralyzed, peckish, petrified, pickled, pificated, piper fou', ploughed, podgy, pretty well entered, primed, pruned, pushed.

Queered, quaffed the bowl.

Raddled, rather touched, razzle-dazzle, reeling, right, Romeo, roaring, roaring drunk, roaring fou', rococo, rotten drunk.

Salted down, salubrious, sawed, scammered, screwed, sees two moons, set up, sewed up, shaking a cloth in the wind, shaky, shaved, shocked, shot, shot in the neck, skaty, skate on, sleepy, slewed, smashed, smeekit, smelling of the cork, smoled, snakes in his boots, snubbed, snuffy, soaked, society slant on, soft, spiff, spiffed, spoon drunk, spoony drunk, spreeish, sprung, squiffed, staggering full, starchy, stewed, stimulated, striped, stropolus, stuffed, sun in the eyes, swiped, swipey.

Taking it easy, tangle legged, tanked up, tavered, thirsty, three sheets in the wind, tight, tight as a brick, tipsy, tired, tired feeling (has), titley, too much fire water, took a snort, top heavy, touched, turkey on his back, twisted, two sheets in the wind.

Unco', under the weather, under the influence, unsteady, up a tree.

Walks on a bias, water logged, waving a flag of defiance, weak-jointed, weary, well under way, wet, whipped, whittled, winey, wobbly.

Yappy, yaupish.

Intoxication as it appears both in poetry and prose furnishes a field for psychological study. The deepest motives for intoxication are expressed here. Of these there are two which run through all the literature. One is the glorification of pleasure and abandon, the other is the desire to escape from pain. The best example of the first is found in the Greek dithyrambic poetry.[1] A spirit of abandon, love of exaggeration and excess, extravagance of language appear everywhere in the literature of drink. Such verses as the following show this spirit:

> "When I am dead with wine my body lave,
> For obit chant a bacchanalian stave."
> —*Omar Khayyám.*

> "The dry and dusty earth drinks,
> The trees too drink her moisture;
> The sea doth drink the rivers,
> The sun doth drink the sea waves,
> The moon doth drink the sunbeams,
> Why cavil then at me, friend,
> That I am fond of drinking?"—*Anacreon.*

In the college song books drinking is the most common theme, excepting, perhaps, love. Here the spirit is for the most part, like that of the Greek dithyramb, one of jovial excitement; but

[1] See § 2.

there is not wanting a shallow pessimism. The praises of drink as a cure for care and trouble are frequently sung. In Heilbrom's "Carmina Clericorum" fifteen of the thirty-one songs are praises of drink.

But there is much of the spirit of deep pessimism running through this literature. Omar Khayyám, to take a single example, expresses well the narcotic motive in intoxication. Fitzgerald[1] criticises those who interpret the quatrains of Khayyám as symbolic, clothing the deity under the figure of wine, as did Hafiz and other Sufi poets, saying that Khayyám is just what he seems, a material epicurean. There is a fine thread of pessimism running through all his poetry. He frequently refers to the wheel of heaven and the world's injustice. He hates the hypocrisy of the pious, and bitterly charges the sins of men to the account of the Creator. For him wine was a means of relief from trouble.

> "Endure this world," he says, "without my wine, I cannot
> Drag on life's load without my cup, I cannot."

And again.

> "Life is a poison rank, and antidote save
> Grape juice there is none."

Khayyám speaks frequently of his sin. It was quite evident that he was a drunkard, for he says:

> "I am a slave of that sweet moment when
> They say take one more goblet and I cannot."

And, as in the case of many other drunkards, wine dimmed for him other pleasures.

He expresses in verse what many drunkards say when he cries—

> "They preach how sweet these Houri brides will be,
> But I say wine is sweeter, taste and see!"

Much might be added to the account of the influence of intoxication upon literature. Its interest is, however, rather for the psychology of literature and language than for the psychology of intoxication. But one must certainly be impressed with the very great influence intoxication has had, especially upon religious belief, and upon imagination and its expression in language.

The doctrine of stimulus. The doctrine of stimulus in the history of medicine is very closely connected with intoxication. The dualistic philosophies coming from Plato and Aristotle, which placed the soul and life in contradistinction, and even in opposition to body and matter, were absorbed into the theory of medicine at an early date. Life was regarded as an entity or principle which opposed or controlled the body. In order to

[1] The Quatrains of Omar Khayyám (Introduction).

cure disease this vital principle must be spurred on to increased effort. Hence the disproportionate use in medicine of drugs which affect the brain and thus change the mental condition, and the slow adoption of drugs which, because they affect organs not connected with consciousness, act in a less noticeable manner.

A long list of early physicians including Galen, Paracelsus, van Helmont and Hoffman, held doctrines similar to each other, in that they assumed a life principle which presided over the development of the body, and which needed stimulation in order to overcome disease. The modern doctrine of stimulation (an excitement of normal functions) is obtained by transferring this hypothesis from the life principle to the tissues of the body itself.[1]

§ 6. Analogues of the Intoxication Impulse.

There are many facts which show that there is a normal love or craving for certain states of consciousness, the common element in which is intensity. Examples of such are the love of mental excitement and high emotional states common among children, religious ecstasy and excitement, second breath (mental and physical),[2] dances, violent games involving both mental and muscular activity, social excitement. Psychologically considered these states are very similar to each other, and a study of them leads to the conclusion that intoxication is one form of expression of a more general impulse which is deep-seated in consciousness and very far-reaching in its effects.

States analogous to intoxication appear in animals, in some species of which states of exaltation are habitual. They are, apparently, more common in birds, but occur also among mammals. One or two accounts of these serve to illustrate this phenomenon which appears in all degrees of intensity from a slight increase in activity to orgiastic performances of the wildest kind.

Besides the various plays of animals, in which there appears to be a love of excitement for its own sake, there are other rhythmically occurring periods of intense excitement. Chapman[3] describes the sky dance of the woodcock as a succession of wild rushes in the air, with always increasing speed and with louder and louder cries, the object of which seems to be to rise to the highest pitch of excitement.

Worth describes a dance of prairie chickens or sharp tailed grouse.

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[1] For a full account see Anstie: Stimulants and Narcotics.

[2] Partridge: Second Breath. *Ped. Sem.*, Vol. IV, p. 375, *seq.*

[3] This and the following descriptions are from Morgan: Habit and Instinct.

The birds, in companies of from six to twenty individuals assemble on some hillock or knoll fifty to a hundred feet across, the floor being worn and beaten smooth by years of tramping. After remaining for a time inactive, one of the cocks lowers his head, spreads out his wings nearly horizontally, and his tail perpendicularly, distends his air sacs and erects his feathers, then rushes across the floor, taking the shortest of steps but stamping his feet so hard and so rapidly that the sound is like that of a kettle drum, and at the same time he utters a kind of bubbling crow which seems to rise from his air sacs, beats the air with his wings and vibrates the air with his tail, so that he produces a loud rustling noise and thus becomes a really astonishing spectacle. Soon after he commences, all the cocks join in rattling, stamping, drumming, crowing and dancing furiously; louder and louder the noise, faster and faster the dance becomes, until at last they madly whirl about, leaping over each other in their excitement.

Hudson in "Music and Dancing in Nature," speaks of the screaming contests of Platan rails, and remarks upon the striking resemblance to the human voice exerted to its utmost pitch and expressive of extreme terror and despair. Wallace says: "We see that the inferior animals, when the conditions of life are favorable, are subject to periodical fits of gladness affecting them powerfully and standing out in vivid contrast to their ordinary temper. Birds are more subject to this universal joyous instinct than mammals, and there are times when some species are overflowing with it."

Groos also speaks of the above mentioned characteristic of animal love dances and play, and explains the intense excitement on the ground that it is necessary that the sexual impulse should have tremendous power, and its discharge be rendered difficult; hence the great and long-continued excitement preceding the act of pairing.

Many examples of a similar love of excitement occurring in the human subject, especially at times of accelerated development might be described. At the adolescent period, when impulses to new lines of action have developed more rapidly than self-control, intense sensation, strong emotional excitement, and even immorality often have a peculiar charm, even for normal people. Monotony, routine, and detail are unendurable. Particularly in the social and collective life is this spirit of sensationalism shown. The queer freaks and the breakings-out and the excesses of college students illustrate both the intensity and the imaginative fertility of this craving. Lancaster[1] speaks of the sudden and inexplicable rebellion against authority which appears in the first years of adolescence.

Primitive peoples also show an intense love of excitement in almost every social event of their lives. A culmination in intense excitement is very frequent, in fact a customary and natural

[1] Psychology and Pedagogy of Adolescence. *Pedagogical Seminary*, July, 1897, p. 85.

termination of all gatherings of uncivilized man, whether for religious or for social purposes. The various shaman cults are as good an example of this tendency as any. A festival lasting a number of days usually has a culminating day or period, or it may end in a wild dance or in general intoxication. A moderate height of excitement maintained for a considerable period of time seems to be unnatural to primitive man. Dancing, especially when, as so often occurs, it is accompanied by intoxication, affords an excellent example of the tendency. A few illustrations will bring out more clearly this characteristic of the mind, which is not confined to any single function of the social or religious life, but is found everywhere,—at marriages, funerals, games and simple social gatherings. But more particularly the public festivals and dances are occasions of throwing off of all control and giving the mind over to the intoxication of movement, of sexual excitement, and general abandonment. Intoxicants may or may not be used to induce these intense states. Pain, scourging, games of torture, fasting, fantastic sights, and hideous sounds, as well as violent movements all serve the same purpose. Public festivals which begin with much dignity often degenerate into scenes of wild disorder before they are finished. The great war dance of the Tupis is an illustration.

> They arranged themselves in groups, and at a well known signal each group began to sing, at first in a low tone of voice, which became louder and terminated in dreadful yells and hideous howls. The jumping was so violent and their efforts were so furious that some of them fell senseless to the ground. Three or four payes or sorcerers stood in the center, shook the tamarak, and blew tobacco smoke from a cane pipe upon the dancers.[1]

Mrs. French-Sheldon[2] says, speaking of some of the customs of the natives of East Africa.

> "The young fellows will collect in groups and dance as though in competition; they dance with their knees rigid, jumping into the air until their excitement becomes very great and their energy almost spasmodic, leaving the ground frequently three feet as they jump into the air. At some of their festivals this dancing is carried to such an extent that I have seen a young fellow's muscles quiver from head to foot, and his jaws tremble without any apparent ability on his part to control them, until, foaming at the mouth and his eyes rolling, he falls in a paroxysm upon the ground to be carried off by his companions. This method of seeking artificial physical excitement bears a singular resemblance to the dances of other nations outside of Africa."

Examples of this tendency might be multiplied to any extent. The reader is referred to the literature of plays and games and dancing.

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[1] Featherman: *op. cit.*, Vol. III, p. 341.

[2] Customs among the Natives of East Africa. *Jour. Anthropological Inst.*, 1891, p. 367.

Certain historic periods seem to have been characterized by a love of excitement. This is well shown by the Dionysiac cults in Greece.[1] It also occurred, in a remarkable degree just before the intellectual awakening at the time of the Renaissance, especially in Italy. All students of the period seem to agree that it was a time of extreme sensuality, accompanied by a love of display and dramatic effect. It was a time of great church feasts, and great civic processions. The carnivals in Venice, in particular (1459), were famous for their great torch-light processions.[2]

Other changes in the national consciousness accompanied this craving for new and strong sensations. Burckhardt[3] says: "In the Middle Ages man was conscious of himself only as a member of a race, people, party, or corporation, but now the subjective side asserted itself and man became a spiritual individual and felt himself as such. Adams[4] says that the Renaissance was more than a revival of learning. It was a revival of emotions also, an awakening of man to a new consciousness of himself and of the world. The work of the Renaissance was to awaken in man a consciousness of his powers and to give him a confidence in himself. It was a craving for freedom which more than anything else characterized the times. There was a change from outer to inner control and the result was a time in which there was no control at all. Hence the great vices of the period. Burckhardt[5] sums up the character of this age by saying: "The fundamental vice of this character was at the same time a condition of its greatness, namely, an excessive individualism. This immorality was a historical necessity; with it has grown up a modern standard of good and evil." He apologizes for the immorality of that day by saying that it was not of low order. Symonds[6] also takes this ground in explaining the illicit loves of this time, saying that they were not merely sensual, but were due in great measure to the demand for imaginative excitement in all matters of the sense.

A striking sex difference appears in all these activities, not only as they occur among animals, but also in the human subject. Ellis[7] says that among primitive peoples the occupations which require intense activity alternating with long periods of apathy are chosen by the male. The monotonous work falls to

[1] See § 2.
[2] For a full account of this period see Burckhardt: The Civilization of the Period of the Renaissance, and Symonds' Renaissance in Italy.
[3] *Op. cit.*, Vol. I, p. 181.
[4] Civilization during the Middle Ages, p. 365.
[5] *Op. cit.*, Vol. II, p. 246-7.
[6] *Op. cit.*, Vol. I, p. 411.
[7] Man and Woman, p. 2.

the lot of the women. It is true also of intoxication, that it occurs far more frequently among men than among women.

A consideration of other secondary sexual differences between male and female shows a similar tendency. Geddes and Thomson[1] speak of the more active physiological habit of the male. His activity is more katabolic; he lives at a greater loss; the physiological habit of the female is more anabolic. Taking all the above described phenomena into account, the most probable explanation is that they are expressions of a general instinctive tendency, and that it has been preserved because it has favored mental development. Granted the existence of an instinctive impulse to seek intense states of consciousness, its preservation can easily be accounted for. (1) It is a direct accompaniment of a healthy and vigorous state of the organism. (2) Intense excitement may have been of service in connection with the regulation of the sexual impulse (Groos). (3) It also serves in the individual as a propædeutic to higher forms of emotional and mental activity. (4) The forms of activity resulting from this impulse have had a very great social value. (5) They have also by favoring activity led to a natural experimentation which has assisted adaptation (Morgan).

At the present time the ability to endure long continued mental activity at a high degree of tension is one of the essential qualities which favor success. For a life of mental activity the excitement and love of strong sensations at the time of adolescence is natural training. There is no reason to believe, therefore, that this impulse will decrease, but rather on the contrary that it will increase, favoring a greater capacity for intense states of consciousness. Directly in line with the conclusion that the forms of activity mentioned above are expressions of a general instinctive tendency is the theory of play as held by Groos. The conclusive argument against the overflow theory of play, as held by Spencer, applies directly to the forms of activity under discussion here, and favors the conclusion that the impulse to seek intense states of consciousness is not an expression merely of a high state of nutrition, but a true instinctive tendency which has grown up as a necessary aid to mental development. Like all other forms of instinctive activity, it may be exceedingly active even in organisms in which a low state of nutrition causes it to be a source of peril, or even destruction.

Doubtless there are conditions of nervous exhaustion in which the craving for excitement becomes abnormal in degree. The sensuality of the decadent days of great nations may be explained as an expression of exhaustion. In the sensuality which followed the Napoleonic wars in France there is a good example of the effect of overstrain and fatigue in causing

[1] The Evolution of Sex. pp. 18, 270.

a craving for excitement and for new sensations. This impulse found expression in the literature of the time, perhaps most characteristically in Huysmans, the novelist.[1]

§ 7. Résumé and Criticism of Theories of the Intoxication Impulse.

In the following section abstracts are given of various theories of the intoxication impulse and the craving for alcohol. Some of these theories are uncritical, but taken in connection with others they show tendencies of thought.

A prevalent opinion about the alcohol craving, one which makes up the philosophy of many who advocate temperance, is that intoxication is a form of sin, and needs little explanation. Another view which explains nothing is that the craving for alcohol is a diseased appetite.

Baer[2] thinks that the craving for alcohol is not an instinctive but an acquired craving.

Gustafson[3] says that the desire for alcohol is a habit becoming instinctive and a form of depraved second nature.

Nordau[4] says that the craving for alcohol is a craving for relief from pain and an expression of a need for stimulation, there being a general condition of neurasthenia, especially noticeable in the upper classes of society and due to the fatigue caused by the sudden incoming of machinery, rapid transit, and exciting occupations. Lett[5] asks "Why do men drink?" and gives about the same answer as Nordau. "Because there is pain. The healthy man has no pain and needs no stimulant. One kind of pain, unrest, is the outcome of an unstable nervous organism. Disquietude, unrest, pain are the causes of drinking."

In an anonymous article in the *University Magazine*, entitled "The Philosophy of Stimulants," a writer expresses the view that stimulants and narcotics are used because they intensify consciousness; they make wider variations in life; our pleasures and pains are too evenly distributed, and it is a matter of instinct with us that we try to summate them.

Moxon[6] says that alcohol weakens common sense in its opposition to individual sense. The power of alcohol in the world is that it keeps down the oppressive power of others and their common sense over the individual sense. Alcohol raises a man's

[1] Leuba: National Destruction and Construction in France as seen in Modern Literature and in the Neo-Christian Movement. *Am. Jour. Psychology*, July, 1893, Vol. V, No. 4, p. 498.

[2] Der Alkoholismus; also Die Trunksucht und ihre Abwehr.

[3] The Foundation of Death.

[4] Degeneration.

[5] The theories of Lett, Monin, Hughes, Day, Danielewski and Forel are to be found in scattered articles in the *Journal of Inebriety*.

[6] *Popular Science Monthly*, 1879, Supplement, N. S. I, p. 30.

individuality temporarily. It reduces the common sense relations between men.

Thomann[1] says that the desire for alcoholic beverages is generally a physical desire, an animal lust.

Monin says that in proportion as civilization perfects itself man seeks in drunkenness a compensation for, and a forgetfulness of, the weariness and chagrin which result from his daily struggle for existence.

The supposition of all those who believe in a specific for the craving for alcohol is that it is a physical appetite which can be destroyed by the use of drugs. A statement of the views of a single one of these will be sufficient to illustrate these medical theories. He has two specific remedies, one to remove the neurasthenic condition which he says is present in all cases of inebriety, and another to remove the craving for alcohol. With these he claims to cure men of all ages in any stage of the disease, and to establish such a normal condition of body and mind that although they may drink again they will never drink again from necessity, or because they are victims of an appetite, but only from choice. He maintains that the craving for alcohol and the desire for stimulants in general, such as hasheesh, morphine, and chloral, are expressions of one disease; they all have their roots in a neurasthenic condition. Other cravings, such as a passion for strong electrical stimulation, are of the same nature, the expression of a lowered nervous tone and a desire for something which will create activity in inactive organs.

The advertisements of specifics which can be administered to a drunkard without his knowledge and cure his desire for alcohol, also illustrate this pseudo-medical and popular view that drunkenness is caused by a diseased craving.

Hughes says that the drink craving is a pathological perversion of physiological cell action, and lies in the realm of the cerebral cortex.

"That there is an organic appetite for brain stimulants which, if not originally so, has become organic through unknown ages of indulgence common to man," says Day, "is beyond dispute. This appetite does not anticipate for its gratification more than the primary or stimulating effects of the drugs used. It is through this appetite that the system is often exposed to an unexpected and undesired effect of the drug and a painful condition of the body induced by such unintentional excess, which can in no other way be so speedily and effectually relieved temporarily as by the repetition of the excess itself, by renewed

[1] *Op. cit.*

stimulation of the organs suffering, or in an obliteration of sense by a more complete narcosis than was at first intended."

Braintwaite[1] says that drunkards are made by the effect of alcohol upon unformed and developing tissue, especially cerebral tissue.

Danielewski says that civilized man has used alcohol so extensively, and for so long a time, that one may with certainty affirm the existence of an alcoholized protoplasm in drunkards just as one finds morphinized protoplasm in cases of chronic intoxication with morphine. The organism can no longer do without it. Hence it follows that the complex of protoplasm and albuminoids is adaptable; that it is not incapable of being disturbed in its fundamental properties; and that it is reconstructed with difficulty.

These notes will serve to show some general tendencies of opinion in regard to the nature of the intoxication impulse.

In the views mentioned thus far no attempt is made to explain the development of the craving for stimulants, except by the hypothesis that it is a result of generations of indulgence; in other words that it is an acquired habit which is becoming a so-called secondary instinct.

Forel has also expressed a similar view in an article in which he speaks of the future of the alcohol craving in the race. "We do not think," he says, "that man could ever adapt himself to the use of alcohol and narcotics, so that they would cease to hurt him, for the following reasons. Experience teaches, (1) the general drinking and narcotic customs incessantly augment the production and the consumption, that is, increase the daily doses which every man consumes in the average. (2) The craving which alcohol and all other narcotics produce drives to such augmentation with peculiar force where severe laws do not counteract. (3) Alcohol, and probably also all other narcotics, poison not only the individual, but also his sperm, the germs of his descendants. (4) The progeny of alcoholists, according to experience, are especially exposed to mental degeneration and to drinking excesses. Their resistibility against alcoholic liquors is never raised, rather very much diminished."

Beard[2] asks the question, "Why does man, so much higher than the animals in every respect, alone possess the vice of intemperance?" "What makes us to differ from them?" and answers, "Mainly our nervous system." Man has a larger, fuller, richer brain than the lower animals; and stimulants and narcotics chiefly affect the brain; therefore man craves for them, finds rest and negative food and pleasure in them, and thus

[1] In correspondence.
[2] Stimulants and Narcotics.

often becomes their slave. The horse does not care for alcohol, for the same reason that it does not care for philosophy, because its brain is not capable of appreciating it."

He says: "The most enlightened nations of our time are Great Britain, Germany and the United States, and in these countries stimulants are used in the greatest abundance and widest variety. Next to these nations in order of enlightenment and in order of indulgence in these substances are France, Russia, Norway, Sweden, Italy and Spain. The semi-civilized nations, as Turkey, Syria, India, China, Japan, South America and Mexico, use some varieties to considerable excess, but have not so many varieties, and do not, on the whole, use as great a quantity of stimulants and narcotics as the nations who are at the head of civilization. The purely barbarous races and tribes use at most but one or two varieties, and, as a rule, to but little excess. Africa seems to have used less than any other continent.

"In civilization the expenditure of force is vastly greater than in barbarism, because the brain, especially, is more active. To compensate for this expenditure, to retard the waste of tissue, or at least to sustain the body amid the cares, toils, and pressure incident to advanced civilization, men resort, not only to a more liberal and abundant variety of food than the savages use, but also most employ a wider range of stimulants and narcotics. It would seem that the use of stimulants and narcotics in general has increased with the advance of the race. In general, also, the higher civilized races use stronger liquors and more abundantly, and since in the lower races there is less moral and other restraint, we must conclude that they are not tempted to drink to excess, that they do not enjoy the exciting effects of the stimulants, as do the northerners. There is ten times as much intoxication in Great Britain and the United States as there is in Germany and France. There is far more of the grosser type of intemperance in the northern than in the southern climates. This difference is due primarily, probably, to difference in environment, climate, etc., and only secondarily to difference in race. The English, the Germans and the Americans are of all people the most energetic. Associated with this courage and vigor is a powerful development of some of the lower passions. They are fond of eating and drinking, and although less licentious, less artful than the French, Italian and Spanish, they are more addicted to coarse and brutal crimes. Coarse crimes and drunkenness are twigs growing on the same stem.

"Drunkenness and the amount of liquor consumed in a given country are independent variables. England uses more alcohol, in various forms, than America, but it has less drunkenness. In France the consumption of liquor is very great, but the French are by no means a grossly intemperate people. The explanation of this paradox is that national intemperance does not result so much from widely diffused habits of drinking as from great excess among a limited number. The poor and ignorant classes among civilized nations are most given to intoxication. They are brought into the presence of the same variety of stimulants as the higher classes, and they have less moral control. Woman, everywhere, uses less intoxicants than man, not so much because her moral force is greater, but because she has less desire for the effects of stimulation."

Beard makes much of the effect of climate in determining the difference of drinking habits in different nations. The effect of climate is to produce types of organization—the effect being shown also in psychic traits. He says "Protestant Christianity is the religion of a liberty-loving alcohol-loving people, who have a strong passion for

independence and for sensual indulgence in its most active and violent forms."

The most important of the recent views in regard to the intoxication impulse is that held by Reid. Of this a detailed account is given here for the reason that it is believed by the present writer not only theoretically wrong, but also to involve a very grave pedagogical error.

Reid is led, after a general survey of the present evolution of man,[1] to the following three conclusions: (1) That every species must necessarily undergo retrogression unless that retrogression be checked by selection. (2) That in such a high multicellular organism as man acquired variations cannot be transmitted. (3) That in such an organism, living amidst immensely complex and heterogeneous surroundings, the action of natural selection has been mainly to develop so extraordinary a power of varying in response to appropriate stimulation, direct or indirect, from the environment, such a remarkable power of individually acquiring fit variations that very much, indeed by far the greater part of the characteristics of such an organism are due to stimulation acting upon this power to vary, are variations acquired by the individual, but variations which are not transmissible. At present man's most formidable enemy is the immensely numerous class of animal and vegetable disease germs which continually threaten the safety of the race, and by ceaseless selection weed out the unfit. Moreover, immunity to one disease germ does not afford immunity to another, and each which comes into contact with man, so as to cause the destruction of a sufficient number of lives, is the object of a special process of evolution.

"On the mental side we find," says Reid, "numerous habitually used drugs and poisons which act with sufficient violence and to the harm of sufficiently large numbers of the race to be the objects of special processes of selection. The chief of these poisons is alcohol. In generation after generation alcohol is the cause of the elimination of a considerable number of the unfit in relation to it, and is the cause of considerable evolution against itself. This evolution may be in one or both of two directions, increasing power of tolerating the poison or increasing power of avoiding it, an increasing power of imbibing alcohol without ill effects, or the diminution of the craving for it, or both. But as increasing immunity to the poison means only imbibing larger and larger quantities, evolution must be in the direction of a decreasing craving for it. This is what we should expect, *a priori*, and this is what we do find. Races which have been long familiar with alcohol, like races long familiar with a prevalent and deadly poison, are less harmfully affected by it than races which have had little or no experience with it, and this because they crave less for it and drink less of it. The peoples of the Mediterranean, the Greeks, the Italians, the southern Frenchman and the Spaniard, who have lived for thousands of years in the presence of an abundant supply of alcohol are preeminently temperate. The natives of North and South America, Australia, Polynesia, Africa, Greenland, whether in Arctic, Temperate or Torrid zone, crave for it so much that they perish in its presence, unless we protect them with prohibitory laws. Races which lie between these extremes in regard to experience with alcohol, as the people of northern Europe, the English for example, are also between them in regard to the resistance to it."

[1] The Present Evolution of Man.

The question as to how the craving for alcohol and other narcotics, the love for those states of mind which they severally induce, arose can be answered in only one way. It can have arisen only as a by-product of mental evolution, a by-product which, in the absence of narcotics was harmless, but which in the presence of them is harmful, and against which, in races long affected by this or that narcotic, a secondary evolution has occurred. This craving, according to Mr. Reid, is a specific craving. Nothing else but alcohol satisfies it. It is not transferable, so to speak, and evolution against other drugs does not affect it.

Reid insists that traits acquired under the influence of alcohol are not transmissible any more than other acquired traits are. To quote, "The craving for alcohol depends upon consciousness, which, in turn, depends upon the presence of nervous structure. That the germ is bathed in alcohol cannot account for the habit being developed in the child."

Racial differences in regard to immunity against alcohol craving are not due to the fact that some races are by nature abstemious, nor is it due to differences in education. The craving for alcohol is an instinct and not an acquired trait. It is comparable to hunger and thirst, or to sexual and parental love; not to a love of books or of paintings, or of country, or of a particular religious system. To quote again, "It is conceivable that a man might be reared in entire ignorance of women, but in such a case, though he knew not what he desired, he would yet crave for them, and his passive desires would instantly be stimulated into activity by their presence. So a savage of a race not rendered resistant by alcoholic selection craves unknowingly for alcohol, for that state of mind which alcohol induces. Racial difference is not due in any degree, as has been maintained, to difference in the strength of alcoholic beverages in use in the different countries. On the contrary, the strength of the craving determines the degree of concentration of the alcoholic beverages."

The degree of intoxication desired by the average individual of any race, when once that desire has been awakened in him by alcohol, is exactly in inverse proportion to the past familiarity of the race with the poison; in other words, it is exactly in inverse proportion to the amount of elimination alcohol has caused in the ancestry. The smallest amount of alcohol produces some mental change. The instinct is never entirely eliminated in any race. The differences in the races lie in the degree of intoxication desired. To quote from Reid once more what seems a very curious piece of reasoning. "The direction of the process has been toward a lesser craving from a greater craving, and in some cases, *e. g.*, the English, the process has been very rapid, since side by side with individuals who have but a little craving for alcohol are found others with a very great craving, and since it frequently happens that parents who crave but little for the poison have offspring that crave very greatly for it, *i. e.*, offspring who have reverted to the ancestral type in which the craving was very great, the greatness of reversion being due to the swiftness of the evolution, owing to which reversion to a not very remote ancestor results in a considerable change of type."

Races which have undergone evolution through alcoholic selection are liable to retrogression when the stringency of that selection is abated. When the innately intemperate have as much influence on posterity as the innately temperate, alcoholic retrogression will ensue. Thus the success of every scheme for the promotion of temperance which depends upon the diminution or extinction of the alcoholic supply, or on voluntary or involuntary abstinence from alcohol, must result in an aggravation of the craving for that state of mind which

indulgence in alcohol induces. The craving for alcohol is like sexual love, an instinct, not an acquired trait. The love of alcohol is born anew with each generation, undiminished except by alcoholic selection.

It is practically impossible to banish alcohol from our midst, and since the craving for alcohol increases with indulgence, we cannot hope that moral influence will ever result in temperance, *i. e.*, in a moderate use of alcohol.

Why not banish alcohol as we do microbes? Because no man craves for disease, and thousands crave knowingly or unknowingly for excess in alcoholic indulgence. In the face of craving for alcohol, we cannot hope to banish that poison permanently. In relation to such a disease as tuberculosis which we cannot hope to permanently banish, we ought to forbid the procreation of the unfit. If alcohol were abolished, the time would surely come after the race had undergone retrogression, when any law would fall into abeyance from disuse. If temperance were founded on voluntary abstinence, the craving would eventually grow so ardent, as a result of retrogression, that no opposing traits would be sufficiently strong to counteract it. The course is to imitate alcoholic selection and eliminate those individuals who crave for alcohol to an excessive degree, at least in so far as to prevent them influencing posterity by leaving offspring.

"It is the same," says Reid, "in regard to the other narcotics. We find that the peoples who have used them the longest are less harmed by them, and have less craving for them than the people who are not accustomed to them."

The important question is, "Does evolution against one narcotic or intoxicant affect another?" It seems probable that the states of mind which these drugs induce are distinct and separate, just as the weakness against separate zymotic diseases are distinct and separate. Therefore it seems probable that a man may be strong against alcohol, but weak against opium, or *vice versa*, though a race accustomed to one may, if debarred from using it, go to greater excess in another, and the presence of one seems to shut out the others, especially when craving for the others has not been strongly awakened.

The foregoing views can be summarized briefly as follows:

The craving for alcohol is—

1. Sin;
2. Craving for relief from pain, nervous weakness or weariness incident to the struggle for existence;
3. Diseased appetite: the effect of an alcoholized protoplasm; a pathological perversion of physiological cell action in the cerebral cortex; a specific pathological craving which can be cured by a specific remedy;
4. A physical craving, an animal lust;
5. An acquired taste;
6. An organic appetite, made so by ages of indulgence, *i. e.*, a "secondary instinct;"
7. Instinct to intensify consciousness, to make wider variations in the mental life;
8. Desire to change the relation of common sense to individual sense;
9. An instinct which is a by-product of mental evolution.

Criticism of Theories of the Intoxication Impulse. All those

theories of the intoxication impulse which refer it back to the sinful nature of man are so uncritical and indefinite that they need no consideration.

The theory that the craving for alcohol is a habit which is becoming instinctive takes two forms. The first, which regards alcohol craving as a "secondary instinct," involves the transmission of acquired characteristics. One's attitude toward such a view would be determined at present by his position in regard to that problem. This theory attributes to the intoxication impulse an accidental origin, and its continuance to an accumulation of habit by inheritance. There are certainly no data to establish the theory. The second form of this theory, namely, that the craving for alcohol is due to alcoholized germ plasm does not require a belief in the transmission of acquired characteristics, but is in much the same condition as the first, as regards evidence. Environment is so complex as to make it usually quite impossible to trace a direct effect of inheritance in any given case. So far as the data studied in this paper are concerned they indicate that the craving for alcohol as such is not inherited at all. Probably no one now would deny that alcohol is capable of so affecting the parent directly as to cause degeneracy and disease in the offspring, and thus indirectly produce a tendency to the formation of abnormal habits, the indulgence in which alleviates pain temporarily. But that the germ plasm is so modified by alcohol as to produce an organism with a specific craving for alcohol is quite unsupported by any evidence. It is probable that the offspring of the opium eater is quite as likely to succumb to a craving for alcohol as the offspring of the alcohol drinker, other conditions being the same.

Cases in which there is said to be an inherited craving for alcohol, which appears even before any experience with it, need a very careful scrutiny before they are pronounced to be what they seem. One case related to the present writer by a physician will illustrate this point. A drunkard had two daughters, both of whom inherited from him a craving for alcohol. One drank at first moderately, then excessively and finally died from the effects. The other has never tasted alcohol but feels she has a craving for it. Many such cases of inherited craving are based upon just such an interpretation of feeling. It is inconceivable how one can have a craving for a thing which is totally outside of one's experience. Suggestion and fear are sufficient to account for all the facts. Another case will show how suggestion might misinterpret these longings. A man accustomed to careful introspection writes as follows: "I have never used alcohol in any form, but often in going by a saloon I have a desire to go in and get a drink. The sign,

"Frank Jones's Golden Ale," and the picture of the foaming glass, have a fascination for me especially on a hot day. Now I have n't the slightest idea what Frank Jones's Golden Ale tastes like. I may add that there is no history of alcoholism in my family." If this man had ever had the alcohol habit, or if there were a history of it in the family, he would have concluded, no doubt, that this longing was a deep-seated craving.

A very normal man of forty remembers as a child of not more than five having once drunk something from a peculiar looking bottle. He remembers distinctly noticing that the people present exchanged sly looks and were laughing at him. He remembers liking the taste of it, and afterwards looking many times for the bottle in order to have more of the drink which he now knows was cherry rum. As he grew up remembering this childish craving he for years believed that he had an inherited taste for alcohol, as there was a history of it in the family, his grandfather being a very heavy drinker. He has since used alcohol at times, moderately, and has no tendency to fall a victim to it.

The simplest explanation to all these cases is that the inherited craving does not exist at all and that suggestion accounts for the whole matter. The facility with which alcohol habits can be exchanged for other similar habits, the effectiveness of cures which act upon the mental processes, the abrupt cessation of the craving when alcohol cannot be obtained, all point to a single conclusion, namely: that the craving for alcohol is concerned with the mental rather than with the physiological aspect of development. The claim that the effect of alcohol upon the system is to produce such a condition of the tissues that it requires greater and greater quantities to produce intoxication is by no means substantiated, especially in cases where there are considerable periods of abstinence. Waugh[1] denies the statement that drug users increase the dose because it takes more and more to produce exhilaration. He says that all whom he has questioned have confessed that they increase the dose because they desire more of the feeling. The same was found to be true in some alcohol cases at least. Some say that less is required to intoxicate as the habit progresses. In cases where drinking is steady day after day, however, there seems to be a capacity for consuming with comparative impunity larger and larger quantities. In cases of relapse after cures by the Keeley and other methods, sudden deaths are due no doubt, to the inability of the system to consume quantities of alcohol which were readily disposed of after long practice.

The strongest evidence against the view that "alcoholized

[1]Cocaine Addiction, *Jour. Inebriety*, Apr. 1898. Vol. XX, No. 2, p. 192.

protoplasm" is the physiological basis of the craving for alcohol, is furnished by abundant testimony that the young drinker is far less amenable to treatment than the old drinker, which could hardly be the case if a slow process of poisoning produced the craving. The sudden cures, especially the psychical cures, also offer evidence against this view. The widespread belief in the deep seated nature of the alcohol craving, that it is a "part of a man's body," etc., has had in the past a pernicious effect. The belief that a habit is incurable does more than anything else to compel its continuance. Cases quoted above show this, and also the effect of the opposite belief (that the habit is broken) in effecting a cure.

The facts brought forward in preceding sections sufficiently prove that the pain in the world is not sufficient to account for the prevalence of intoxication and drunkenness. There can be no doubt that pain is one of the most important causes of drunkenness—but it is not the only cause, and the great intoxication motive in its origin and development is not connected with pain at all, but rather with pleasure. The theory that alcohol craving is an "animal lust" or a physical craving is too indefinite to admit of discussion.

The theory that alcohol is used because it causes wider variations in life, which is otherwise too monotonous, expresses vaguely an important psychological factor in intoxication, as does also the view that alcohol changes the relation of common to individual sense. Beard's theory of the close connection between high mental development in a race and a love of stimulation also accords with the view upheld in this paper.

Reid's theory that the craving for alcohol is a specific craving, a by-product of mental evolution, that it exists in every one, whether he is aware of it or not, and that it is in process of gradual elimination from the race by a selection against it is out of accord with the facts. The transferableness of the alcohol habits for other habits show that it is not such a specific craving. Even though it were true that in nations which have been long accustomed to alcohol there is less craving for it than in nations in which the habit has been recently acquired, this does not prove that the relation is one of cause and effect. It is probable, as Reid says, that a process of elimination of the most unfit in regard to alcohol, as of those who are unfit in other respect, has been going on slowly. But this is inadequate to account for the differences in the drink craving of the individuals of different nations. The history of nations shows also that the elimination of the alcohol craving has not been a uniform process. As we have seen, times preceding eras of high culture have been times of gross intoxication, temperance has come with the highest culture, and then intemperance again

as the nation decayed. Lower races which have long been accustomed to native alcoholic beverages perish in the presence of the stronger drinks of civilized men, showing that their long acquaintance with alcohol has not eliminated the craving for it. It is well known that Europeans, especially Italians (who, Reid says, have not a strong craving for alcohol), on coming to America readily succumb to the drinking habits of the country.

There is nowhere in the history of drink an account of the sudden introduction of alcohol into a civilized country. In that case, we should expect if Reid's theory is correct, the most disastrous effects, for no degree of civilization would be in the least a safeguard against it in the absence of a long period in which selection had been at work to eliminate the craving. A good example of this, though not on a national scale, is to be found in the case of families which have been abstainers for a number of generations. On Reid's theory we should expect that the descendants of these would be weak in the presence of alcohol. This does not appear to be true; in fact quite the opposite conclusion is warranted.

The sudden introduction of alcohol into a nation in such a state of growth as that of our own country at the present time, if it were possible, would probably not, as Reid says, result disastrously, for the reason that selection has already produced, in connection with general advancement of civilization, those qualities of control which antagonize all forms of destructive habits.

Reid's theory is constructed out of the analogy which he draws between zymotic diseases and habits of a mental nature, assuming that the latter are as specific as the former. This is the error upon which the other errors of the theory, as well as of its practical conclusions are based. The most valuable part of the theory is the term "by-product of mental evolution," which, though in itself explaining nothing, calls attention to the relation between the alcohol craving and normal mental development. Upon that relationship the view of the present writer is based.

§ 8. Summary of Facts and Outline of a Theory of the Intoxication Impulse.

Some of the facts concerning intoxication which must be taken into account by any theory of the intoxication impulse are the following: (1) Intoxication is one of the most important parts of the religious and social life of primitive man. The use of alcoholic beverages arose in connection with the religious social life in the effort to heighten the religious social-consciousness. Its use for these purposes among primitive peoples is widespread

and almost universal. (2) The drugs which have been widely used for intoxication purposes are capable of producing quite different effects. They may either increase or decrease the *intensity* of consciousness. (3) The state of intoxication is essentially a succession of emotional states having a distinct climax. In the pleasure stage the consciousness of self is increased, and the external world diminished in importance. (4) The historical importance of intoxication is shown by the deep impression it has made upon the literature and language. (5) The history of intoxication shows that it has been exceedingly prevalent at times of rapid development. In the individual intoxication habits are most likely to be formed during adolescence, and during this period they are more difficult to overcome than later in life. (6) The study of individual cases shows that taste is a small factor among the causes of the intoxication habit. The craving for alcohol is not a physical craving, but is essentially a craving for a mental state. The drunkard does not recognize the craving as a specific craving for alcohol, and when for a time alcohol cannot be obtained there is little left in consciousness of the craving. There is also evidence to show that the alcohol habit and the other drug habits are readily interchangeable. A man can be cured of one by substituting another. (7) The whole history of intoxication shows its close connection with the social-consciousness. The feeling is so strong that many habitual drinkers regard it as disgraceful to become intoxicated when alone. (8) A study of analogues of the intoxication state leads to the view that there has grown up in the race a strong impulse to seek intense states of consciousness, and that this impulse has been favored by natural selection for several reasons.

The results of a necessity for a strong impulse to seek intense states of consciousness and a consequent centering of selection upon this impulse may be summed up as follows:

1. An increasing instinctive tendency to seek intense states of consciousness.
2. An increasing capacity for self-control. (A capacity for intense mental activity plus an adequate control is the condition of highest efficiency.)
3. A greater capacity for pain and a tendency to revert to more primitive states of consciousness.
4. An increasing number of defective and abnormal cases.

The intoxication impulse is to be regarded as one form of expression of the general instinctive tendency[1] to seek intense

[1] In regard to general instinctive tendencies the following from Groos is in point. At the moment when the intelligence reaches a point of development where it is more useful than the most perfect instinct, natural selection will prefer individuals in whom instinct appears only

states of consciousness, and not as an independent impulse which has become instinctive by reason of centuries of indulgence, nor an instinct which has grown up as a by-product of mental evolution. The prevalence of the special form of the expression of this general impulse in intoxication has probably been greatly favored by the assistance which it has given to the social consciousness.

The desire to revert to more primitive states of consciousness, accompanying a condition of high pressure, is the impulse which appears everywhere in the literature of drink as the narcotic motive. This tendency of man to look behind him has placed the golden age in the past; it has created mythic accounts of Fountains of Youth, of Paradises in remote lands, of Utopias and Nirvanas. All these are expressions of fatigue, of a longing away from a too tonic environment. This spirit is the keynote of mysticism, the constant theme of which is rest; to be relieved from weariness and pain. The cry of "back to nature," which is raised when the weight of the accumulated culture and conventionality becomes burdensome, is another expression of this impulse. Rousseau is as good an example as any one of this tendency in philosophy; in his case there is plenty of evidence to show that the psychological foundation of his hatred of society and his worship of nature was an abnormal physical condition. The same psychological foundation must be attributed to much of the *laissez-faire* ideal as it appears in education and ethics. Nietzsche[1] sees the true nature of this motive, hence his contempt for pity. "What we need," he says, "is pain, more pain." Again he speaks of the two great European narcotics, Christianity and alcohol; these he places together, doubtless because he recognizes in both the impulse to seek an artificial means of escaping pain, in both a means of compensating for or palliating the sternness of reality. "Pain spurs the nervous system on," Mosso says. It creates states of second breath. The seeking of artificial means of alleviating it whether it be by narcotics, by the over-development of the social consciousness, or by socialistic schemes is an expression of the longing backward, away from the influence of natural selection and the struggle for existence. This is an impulse common to all minds in a degree. It appears in normal relaxation, in reverie, and in sleep, all of which states considered from the standpoint of evolution are reversions. The narcotic impulse is well expressed in the hedonic narcosis, which is pessimistic, representing a desire to escape from the will to live; intoxication, on the other

in an imperfect form, manifesting itself in early youth in activity purely for exercise and practice. The Play of Animals, p. 44, preface.

[1] Ellis: Affirmations.

hand, is optimistic and symbolizes the will to live. The relationship between optimism and intoxication is touched upon by Parker,[1] in an article on the psychology of belief. "Excitement of any sort," he says, "seems to quicken conviction. Stimulants arouse belief. Belief is an expression of the instinctive force of life."

It was found that all stimulant-narcotics were capable of affecting the consciousness in two opposite ways. They can increase or diminish its intensity; this characteristic coincides with the facts in regard to the motives which lead to their use. In accordance with an evolutionary standpoint the drunkard is to be regarded (1) as one in whom the craving for intense states of consciousness is over-developed, or who is lacking in control; (2) as one who (usually as a result of pain) has an abnormal craving to revert to a state of consciousness which is less intense.

(It matters little, however, whether in the last mentioned case the impulse be regarded as a true instinctive tendency which has grown up in connection with other instincts which have favored mental development, or whether the painful state be regarded as simply the cause or occasion of an abnormal activity of a normal instinctive craving.)

To sum up this evolutionary theory: the intoxication impulse is not a physical craving nor a specific impulse but it is one form of expression of a general instinctive tendency, which has developed in the race as an aid to mental growth. This impulse is not merely an expression of a surplus of energy but is instinctive. In explaining the prevalence of intoxication, there must be taken into account, also, the narcotic effect of intoxicants, and also an impulse to revert to a less intense form of life.

A single general conclusion may be stated as follows: The most determining factors in the life of man are not the definite, specific instinctive impulses which appear to govern to a greater extent the actions of animals, but certain general impulses which are innate. These tendencies are exceedingly plastic, and probably those impulses which have been developed for the purpose of accelerating mental growth and those impulses which seem to determine long continued and definite lines of conduct are the most plastic of all. It is possible that too much has been made of the rigidity of habits and also of the limits of the range of the human instinctive activities in general. A practical conclusion which results from such theories as those of Reid, who maintains that the craving for alcohol is a specific craving, has been mentioned above, namely, that the only way in which

[1] *Popular Science Monthly*, Vol. LI, p. 749, 1898.

man can become safe in the presence of alcohol, is by a process of selection, which will weed out those who have the craving for it in an abnormal degree. This process can be accelerated by allowing all to have an opportunity to test their control, and by preventing those who fail from generating offspring. If alcohol is abolished from the world, the craving (increased by the removal selection) will cause a disastrous return to drinking at some future time.

Such a view receives no support from the evidence of the present study. In fact quite the opposite practical conclusion is indicated. If the craving for alcohol is one expression of a general instinctive tendency, the selection which continually favors the type of mind which craves intense consciousness also favors a general self-control, so that a process of evolution would go on in the entire absence of alcohol until such a high degree of general control was developed that alcohol, if then suddenly introduced, would have little effect except upon the minority who were constitutionally unfit in other respects, as well as in the matter of resistance to alcohol. There probably is no reason derived from an evolutionary view why alcohol should not be entirely abolished from the world, and the craving which it satisfies be turned into some more useful channel. Its social need is no longer apparent, in fact, it now on the whole favors an over-development of the social consciousness which is harmful to a great many. It is a mistake to think that free access to alcohol decreases the number of the unfit in regard to it, for the reason that in exposing all to this selection, many whole families are injured from which weakness might otherwise be eliminated in a few generations; for a slight degree of craving on the part of a parent may, if indulged, produce degeneracy in the offspring, by direct effect of the alcohol, while many others are indirectly injured. Evolution of control of all such habits as the alcohol habit would therefore go on much faster in the entire absence of alcohol as a factor in selection. The removal of painful conditions, and the utilization in useful channels (rather than the suppression) of the plastic impulse which causes intoxication are the pedagogical lines indicated by the present study.

It was stated at the outset that the interest in the present problem grew largely out of a desire to test the value of psychological methods in dealing with certain ethical problems. Any one of a large number of impulses which are important because they determine morbid conduct might have been chosen for similar study, as for example, the gambling impulse, envy and jealousy, or the sexual impulse.

It may well be maintained that a psychological standpoint is too limited, and that these suggested problems of ethics are

larger than psychology. That would readily be granted. Indeed it seems inevitable that ultimately a broad biological method must be adopted (based upon a monistic philosophy) in which the individual is the unit, and in which psychological and physiological data will be placed on equal terms and supplement or mutually explain each other. If we are willing to adopt such a monistic hypothesis, the impulses and instinct feelings, their differences from individual to individual, and their changes in the same individual are to be regarded as the correlates or reverse side of exceedingly complex anatomical, physiological, and chemical factors. To attempt at present to study ethical problems from the side of the physical sciences, is to be hopelessly lost. There remains the psychological approach, and its advantage consists in the fact that the psychical elements to be studied, the impulses, are comparatively simple, unified, or synthetic expressions of very complex physical and chemical conditions. For these reasons it is probable that for a long time to come psychological methods will be of most service in the study of ethical problems.

II.

EFFECT OF SMALL DOSES OF ALCOHOL UPON THE ABILITY TO DO MUSCULAR AND MENTAL WORK.

§ 1. Résumé of Recent Literature.

Kräpelin's[1] studies began with one on the effect of alcohol upon reaction times. Doses of from 25 to 60 grams were used, and four subjects were tested. There was a shortening of the time under the influence of small doses of alcohol, and an increased shortening with an increase of the dose up to a certain limit. The increase began to appear during the first five minutes, and reached its maximum during the first twenty minutes. With a larger dose the reaction time was lengthened, or the period of increased speed was shortened, and there was a greater lengthening of time with an increase of the dose. In all but two cases when there was an initial shortening of the time, there occurred later a lengthening of the time beyond the normal. Dietl and von Vintschgau[2] used from ½ to 1 bottle of champagne, and found that if the "quantity be not very great" the reaction time is shortened for a certain period. The quickening

[1] Kräpelin: Ueber die Einwirkung einiger medicamentöser Stoffe auf die Dauer einfacher psychischer Vorgänge, *Wundt's Studien*, 1883.
Kräpelin: Ueber die Beeinflussung einfacher psychischer Vorgänge durch einige Arzneimittel, 1892.

[2] Dietl und von Vintschgau: Das Verhalten der physiologischen Reactionszeit unter dem Einfluss von Morphium, Caffee und Wein, *Pflüger's Archiv*, XVI.

lasts longer when the wine is drunk slowly and in small quantities.

Exner[1] found that one bottle of Hochheimer changed the reaction time from 0.1904 sec. to 0.1997 sec., and a second bottle caused a still further slowing to 0.2884 sec., and later to 0.2969 sec.

Warren,[2] using varying quantities of absolute alcohol, comes to a negative result, and concludes that although the results suggest that the reaction time may be quickened after alcohol, and that the later effect is in the direction of a slowing, such a conclusion is not fairly established by his own observations, and, indeed, it is hard to make out any effect of alcohol on simple reaction times.

Several experiments have been made upon the effect of alcohol on the power to make muscular contractions. Lombard[3] found that the taking of whiskey or claret was always followed by increase in the muscular power. No depressing after-effect was observed. He found, however, that the muscle when stimulated by electricity contracted with less force after alcohol had been taken, at the same time that the voluntary contractions were increased in force. His conclusion that the contractility of muscle-tissue is decreased by alcohol is confirmed by Hemmeter's[4] experiments upon the effect of alcohol on the isolated heart.

Kräpelin's dynamometer tests show nothing conclusively. With one subject alcohol caused an increase in the muscle power, and in the other it caused a decrease. Two other experimenters have recently published the results of tests with the ergograph upon the muscular power, the studies being primarily to determine the comparative effect of alcohol upon fatigued and fresh muscles. Frey[5] finds that the power of a fatigued muscle increased after the taking of alcohol, while in the fresh muscle there was no change. Destrée[6] repeated Frey's experiments, alternating normal with alcohol tests, 10 grams of absolute alcohol being used. He found that in both fresh and fatigued muscle there was a rise in the curve, occurring from one to two minutes after the taking of alcohol. This increase lasted from

[1] Exner: Experimentelle Untersuchungen der einfachsten psychischen Processe, *Pflüger's Archiv*, VII.

[2] Warren: Alcohol and Reaction Time, *Journal of Physiology*, Vol. VIII, pp. 311-348 (1887).

[3] Lombard: Some of the influences which affect the power of voluntary muscular contractions, *Journal of Physiology*, Vol. XIII, No. 1 and 2, 1892.

[4] Hemmeter: Comparative effects of certain members of the ethylic alcohol series ($C H_4 O$ to $C_5 H_{12} O$) on the isolated mammalian heart.

[5] Reviewed in the *Correspondenz-Blatt für Schweizer Aerzte*, XXVII, No. 2, Nov. 15, 1897, p. 675.

10 to 30 minutes. Then there was a drop in the curve, and it finally sank below the normal. The larger the dose of alcohol the more rapid the onset of the depression and the longer its continuance.

Taking all the foregoing experiments into account, it seems that for those processes which are predominantly motor, the effect of moderate doses of alcohol is at first to cause an increase in the power and then a decrease,—or a quickening followed by a slowing, if the question is one of time. The experiments of Lombard, and those of the writer, presently to be described, furnish some evidence for the conclusion that, at least in the case of the subjects tried, a dose of alcohol may be made small enough to cause a stimulating effect, which is not followed by a depression, or after which the depression is very long delayed.

Processes of a mixed or predominantly sensory or associational type, are more difficult to experiment upon and the results are less definite. Aschaffenburg[1] has recently made a study of the work done by four typesetters on abstinent and alcohol days. His subjects were all beer drinkers, but abstinence was maintained for the purposes of the experiments. Doses of two hundred grams of an 18% Greek wine were used, administered after the first 15 minutes' work. Less work was done in an hour on alcohol days than on abstinent days. In all cases but one the amounts done on alcohol days fell below the estimated expectation and in each case the total amount of work done on an alcohol day was less than that done on an abstinent day. There was no qualitative change in the work. Smith,[2] using from 40 to 80 grams of alcohol, given in small doses throughout the day, tested the ability to add and to learn nonsense syllables. Groups of alcohol days were alternated with groups of normal days. The effect of the first day's alcohol was to paralyze the power of improvement. After some days there appeared a summation effect, and less work was done each day than on the day before. An after-effect was apparent eight days after the alcohol series ended, for, on its resumption, the work fell off much more rapidly than during the first series. Nonsense syllable learning was affected more than adding. In the latter case, less than a third as much work was done on the last alcohol day as on the first.

Kräpelin in his experiments upon mixed processes found variable results. In the adding tests, all seven subjects showed an increase at first. In learning twelve place figures a similar increase appeared in every case. In reading, the total amount

[1] Kräpelin's *Psychologische Arbeiten*.

[2] August Smith: Die Alkoholfrage und ihre Bedeutung für Volkswohl und Volksgesundheit.

done was increased by alcohol in all but two cases. In all these experiments, alcohol caused a greater irregularity and variation in the work product. Tests upon the quality and rapidity of association showed a change in the character of the reactions. There were greater irregularities in the alcohol series and more "outer" associations. Averages for a series of twelve days show that on the whole the association time was longer on the alcohol than on the normal days. Kräpelin concludes that alcohol tends to increase association time. Still his tables show that there was sometimes a shortening of the time, as an initial effect. From his whole series of experiments, he concludes that while the effect of alcohol in moderate doses upon the motor processes is to cause an initial stimulation, and then depression, and in larger doses depression from the start, the effect upon all sensory processes is depression. The variations from this law in the processes tested Kräpelin thinks may be accounted for by the presence of a motor factor in the processes.

§ 2. Experiments of the Writer.

The writer's own experiments, performed chiefly on himself and with small doses of alcohol, bear upon two points: (1) The effect of alcohol upon physical work with the ergograph; and (2) the effect upon the psychophysical processes of adding, reading, and writing.

A. *The Effect of Alcohol upon Work with the Ergograph.*

Apparatus and Methods. The ergograph used was a Salter's hand dynamometer securely fastened in a horizontal position on a table and provided with a writing point attached directly to its shaft. A record of the usual form was thus obtained upon a kymograph drum, while an endless tape, similar to that described by Lombard,[1] was also attached to sum up the contractions.

The method was the following: One hundred maximum contractions were made, at intervals of 1.6 sec., a metronome marking the time. The remainder of a ten minute period (7 m. 20 sec.), was used for rest. The round of work and rest was then immediately repeated. Six of these rounds (six hundred contractions in all) were made in an hour. The time of day for experimenting was from 8 to 9 A. M. On days when alcohol was taken the dose was 90 grams (in a few preliminary tests 60 grams and 45 grams), of a 33⅓% alcohol, and was taken five minutes before work began. By preliminary practice the hands and arms were hardened to the work.

[1] *Op. cit.*, p. 4.

Results. The ergographic experiments fall into three groups. (1). In the first group experiments were made upon two subjects, H and P. H worked thirteen consecutive days, two hours per day, from 8 to 9 in the morning, and from 5 to 6 in the afternoon. On the fifth, sixth, seventh and eighth days 60 grams of 33⅓% alcohol was taken, both morning and evening. For the four alcohol days the average for a single round (100 contractions) is 100.6 cm. (mean variation, 3.0). For nine normal days, five preceding and four following the alcohol days, the average is 105.6 cm. (mean variation, 2.6). The averages for the even ing work are, for the alcohol days, 104.9 cm. (m. v., 1.1) for six normal days, three preceding and three following the alcohol days, 108.7 cm. (m. v., 2.2), showing less work done in each case on the alcohol days.

The results of H's[1] work, given by rounds, follows.

Table showing average for each round for morning and afternoon work on normal and alcohol days, Subject H.

	ROUND 1.	ROUND 2.	ROUND 3.	ROUND 4.	ROUND 5.	ROUND 6.
Normal 9 days, A. M.,	107.3 (4.2)	108.5 (4.1)	106.2 (3.3)	105.1 (3.5)	102.9 (4.1)	103.6 (4.1)
Alcohol 4 days, A. M.,	104.1 (6.5)	102.3 (4.0)	100.4 (4.6)	100.2 (3.0)	98.0 (2.9)	100.9 (2.1)
Normal 7 days, P. M..	110.8 (5.0)	108.9 (5.0)	110.5 (2.8)	109.2 (3.0)	106.2 (2.4)	106.7 (1.9)
Alcohol 4 days, P. M.,	109.0 (1.2)	108.6 (1.2)	105.9 (2.5)	103.2 (1.4)	101.6 (.9)	101.8 (2.3)

Subject P[2] worked 25 days between December 10, 1897, and January 8, 1898. December 11 to 20 and January 5 to 8 were normal days. On December 21, 22, 23, 24, 30, 31, and January 1, 2, 3, 4, 45 grams of 33⅓% alcohol was taken five minutes before work began. The average for the first four alcohol days is 77.5 cm. (m. v., 3.2): for the four preceding normal days the average is 78.0 cm. (m. v., .7). The average for the alcohol days, from Dec. 30 to Jan. 4, is 101.7 cm. (m. v., 2.1), and for the eight nearest normal days 101.7 cm. (m. v., 7.1), showing that the total amount of work done was not affected by the alcohol. When, however, the averages for each period of the alcohol days are placed beside the averages for the normal days so as to show the typical fatigue curve under each condition, a result is obtained which appears also when the averages are taken separately for the two groups of alcohol days and the nearest normal days, namely, a slight but regularly increasing stimulating effect of the alcohol.

[1] H is a man of 37 in excellent health. The results are given for convenience in terms of centimeters as registered upon the tape. A centimeter equals, approximately, a pull of 100 pounds.

[2] Man of 27 in good general health, of nervous temperament.

(2). The second group of experiments extended from January 9 to February 25, 1898, and was made by subject P alone. The experiments were performed between 8 and 9 in the morning. Ninety grams of 33⅓% alcohol was taken. The order of days was as follows: Jan. 9-11 and 13-14 normal; 15 and 16 alcohol; 17 and 20 normal; 21 and 22 alcohol; 24 and 26 normal; 27 and 28 alcohol; 29 and 31 normal; Feb. 1 and 3 alcohol; Feb. 4 and 5 normal; 7 and 8 alcohol; 9 and 14 normal; 16, 19 and 21 alcohol; making a total of 16 normal days and 13 alcohol days. The averages for the whole series are normal 108.6 (m. v., 4.3), alcohol 108.7 (m. v., 6.6), showing, as before, no appreciable effect of the alcohol upon the total amount of work done. When, however, the work of the ten-minute periods is not thrown together into a general average, but taken separately, the effect of the alcohol is clear in a slight increase, followed by a slight decrease of power, which happen in this case to compensate each other. The following table shows the average for the ten-minute periods separately, with the effect of the alcohol:

Period.	I.	II.	III.	IV.	V.	VI.
Normal days,	107.5 (.99)	110.8 (1.25)	109.7 (1.20)	108.6 (1.13)	108.0 (.99)	106.8 (.74)
Alcohol days,	108.3 (1.40)	115.1 (1.89)	111.0 (1.65)	107.7 (1.69)	105.9 (1.73)	105.0 (1.59)
Effect of Alcohol,	+.8	+4.3	+1.7	−.9	−2.8	−1.8

The table shows that there is a stimulating effect due to the alcohol which lasts during the first half hour, and then a depressing effect which persists until the end of the work period. Comparison of the amount of work done on alcohol days, taking the days themselves in two sections, confirms the results given in the table.

The pulse rate was taken by the subject for the first three minutes of each rest period. The average results for 26 days show a quicker pulse on the alcohol days—less than two beats in a minute, except in case of the second ten-minute period, when the difference is slightly over three. The average for the whole series of days is, for the normal days, 115.6 (m. v., 4.8), for the alcohol days 117.3 (m. v., 4.9). Dividing the whole series of days into two periods, and averaging them separately, gives similar results.

(3.) The experiments just considered show the effect during the hour immediately following the taking of the alcohol. Those of the third group were undertaken to show the effect during the second hour. They were made, however, under somewhat different conditions. The method was the same as before, except that the number of contractions was 50 instead of 100, and that

during the rest periods mental tests were made. The same amount of alcohol was used, but the first hour was filled with other tests, and the muscle tests did not begin till the second hour, *i. e.*, the alcohol was taken at 7.55 A. M., and the muscle tests were made between 9 and 10 A. M. The groups included 20 normal and 10 alcohol days, and the order was N. A. N., N. A. N., etc.; an alcohol day between two normal days. The total amount of work on the alcohol days falls short of that on the normal days, and less work was done in each of the six periods. The averages for the whole hour's work are: normal 70.2 (m. v., 3.2), alcohol 68.6 (m. v., 3.8). The averages for the first half hour are normal 73.0, alcohol 71.3, and for the second half hour normal 67.4, alcohol 66.0.

The results by periods are given in the following table.

Table showing the effect of alcohol upon muscle work during the second hour.

Round.	I.	II.	III.	IV.	V.	VI.
Normal 20 days,	71.0 (.73)	75.2 (.80)	72.8 (.73)	69.4 (.72)	67.3 (.68)	65.5 (.73)
Alcohol 10 days,	70.4 (.63)	73.3 (1.17)	70.4 (1.61)	67.8 (1.42)	66.0 (1.37)	64 2 (1.10)
Loss,	—.6	—1.9	—2.4	—1.6	—1.3	—1.3

Summary of Effect of Alcohol upon Muscular Work. The effect upon subject H of 60 grams of 33⅓% alcohol, taken just before work began, was to decrease decidedly the working power.

Forty-five grams did not affect the amount of work done by subject P, but a comparison of the curves for normal and alcohol days indicates that the alcohol produced a slight, but steadily progressive stimulating effect.

Ninety grams also failed to affect the total amount of work done by P, but in this case the effect is clear in an alteration of the work curve. There is an increase in the amount of work done during the first half hour on the alcohol days, and a decrease during the second half hour.

The effect of 90 grams upon the amount of work done during the second hour after the alcohol was taken was to decrease the amount, which was less for each period during the hour.

B. *The Effect of Alcohol upon the Rapidity of Adding, Reading, and Writing.*

The experiments upon these processes covered a period of thirty-three days, being carried on simultaneously with those last described. The amount of alcohol taken was 90 grams of 33⅓%, taken at 7.55 A. M. Work was begun at 8 A. M., and

continued until 10 A. M. During the first hour there were six 10-minute periods of tests made in the following order: adding, reading, tapping, writing. The apparatus used for tapping proved unsatisfactory, and, although the tapping was continued in order not to alter the conditions for the others, it will not be considered here. The tests occupied approximately 7 minutes of each 10-minute period. The remainder of the period was given to rest. For adding, sheets containing 16 columns of figures, 25 in each column (400 in all) were used, the same sheets being used each day, but in a different order. The reading test consisted in reading audibly at a maximum rate, the figures which had just been added. For a writing test digits from one to nine were written at maximum speed, preliminary practice having been made in order to acquire a uniform movement. During the second hour the same order of tests was followed except for the insertion of the ergographic work described above.

Adding. The average adding time for the whole series is normal 162.3 sec. (m. v., 7.4 sec.), alcohol 160.9 sec. (m. v., 6.9 sec.); for the first hour, normal 163.0 sec. (m. v., 7.0 sec.), alcohol 161.2 sec. (m. v., 8.7 sec.); for the second hour, normal 161.7 sec. (m. v., 7.1 sec.), alcohol 160.7 sec. (m. v., 5.6 sec.).

The effect of the alcohol is slight, but so far as it appears is rather in the direction of a quickening of the process than the reverse.

Reading. The averages for the whole series are normal 94.2 sec. (m. v., 2.6 sec.), alcohol 94.2 sec. (m. v., 1.9 sec.); for the first hour, normal 94.0 sec. (m. v., 2.4 sec.), alcohol 93.7 sec. (m. v., 1.8 sec.); for the second hour, normal 94.5 sec. (m. v., 2.7 sec.), alcohol 94.7 sec. (m. v., 2.2 sec.).

Here, as in the case of the ergographic work, the effect is first a quickening and then a slowing (both insignificant and mutually compensating in the general average, but appearing when the course of the work is considered). By subtracting the reading time from the adding time, the time consumed by the association process in adding is obtained approximately. The results obtained in this way bring into greater relief the effect of the alcohol which appears in the results of the adding test, namely, a quickening of the process.

The averages for the whole series are normal 68.0 sec. (m. v., 5.6 sec.), alcohol 66.7 sec. (m. v., 6.5 sec.); first hour, normal 68.9 sec. (m. v., 5.6 sec.), alcohol 67.5 sec. (m. v., 8.9 sec.); second hour, normal 67.1 sec. (m. v., 5.5 sec.), alcohol 65.9 sec. (m. v., 5.5 sec.).

Writing. The average number of figures written in each period is, for the whole series, normal 225.2 (m. v., 14.2 sec), alcohol 225.8 (m. v., 15.1); for the first hour, normal 221.6 (m.

v., 14.3), alcohol 224.3 (m. v., 16.5); second hour, normal 228.9 (m. v., 15.6), alcohol 227.4 (m. v., 14.5).

The difference is again hardly perceptible, but so far as it appears, the effect of the alcohol is a quickening of the work during the first hour, followed by a slowing during the second hour. As regards the quality of the work, the results are uncertain.

In summary of all these psychophysical tests it may be said that the effects of the alcohol are slight, but that in adding, which is mainly an association process, the alcohol seems to produce in general a slight quickening which lasts nearly to the end of the second hour, and in reading and writing, which involve more muscular action, the effect resembles that found with the ergograph, namely, a period of quickening followed by a period of retardation. These results do not confirm Kräpelin's conclusion that the 'sensory' process (adding is regarded by him as a "sensory" process) is depressed by alcohol from the start, while the motor process alone is at first stimulated. In fact the opposite seems to be true. The association process is quickened while the motor processes appear to be more likely to be slowed by the alcohol. It could not be discovered in any case that the depressing effect of the alcohol persisted until the following day.

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TWO CASES OF SYNÆSTHESIA.

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Many accounts have been published, in scientific and popular form, of the phenomena of synæsthesia, and chiefly of the form known as colored hearing. While the popular accounts are, as usual, untrustworthy and meagre, even the scientific publications are, with the exception of a few detailed descriptions, rather attempts at cataloguing than systematic investigations into the nature of the individual cases treated. For this reason it seemed worth while to make a careful and extended study of the two cases which form the subject of this paper. Although similar tests were given to both subjects, the reactions were so dissimilar that the treatment must needs be separate.

CASE I.

The first case is that of *M* (Miss M. F. McClure), a senior student in the Department of Psychology. While serving as subject in an experiment upon the qualitative discrimination of clangs as conditioned by time interval, *M* developed a form of judgment which was clearly based upon secondary visual criteria. The two given tones of the Appunn tonometer were followed by the appearance in the visual field of the closed eyes of light lines arranged horizontally against a luminous background, at times vaguely tinged with color, usually with pink or green. The higher tone generally appeared as a horizontal line above the lower; at times the line of the lower tone was darker. Later, in the course of experimentation, the ladder formation was less frequent. The tones, however, as a rule occasioned clouds of color, though the colors themselves did not always form a basis for judgment.[1] The frequency and vividness of these visual concomitants suggested the systematic investigation of the case.

[1] The variety of combinations reported is too large to admit of detailed mention. The following is a piece of introspection taken at random from the record: "The first tone was high up in the visual scale, of greenish color (while the tone lasted), with the impression of a ladder formation. The second took its place below the first and determined the judgment."

§ 1. *Historical.*

No trace of colored hearing can be found in the other members of the family. The hypothesis of heredity[1] seems also to be refuted by the fact that the first instance of the phenomenon was quite sudden and hallucinatory in character, and of late origin. In *M's* own words:

"In 1894, at the age of 16, I heard Melba sing the casket (jewel) song in *Faust*. My eyes were wide open. Suddenly I saw a greenness, rich and flowing. It seemed to move as if it were almost liquid, and occasionally it sparkled. It flowed downward obliquely from right to left, and seemed to correspond to the character of Melba's voice. I was not looking at her at the time. The color was not a tint of green of which I am especially fond, but it was very vivid and beautiful. I had been anticipating Melba's singing for some time. Shortly before, I had heard Nordica, but had no visualizations."

After this experience colored hearing, especially with emotionally stirring music, became quite frequent. The colors are not obtained by a deliberate attempt to see them; indeed, such an attempt rather tends to prevent their appearance. In general they are luminous, diaphanous clouds of color (though at times in definite figures) floating over a dusky background; and they are always seen projected[2] to a position about 20 cm. from the eyes. They rarely cover the whole field.

The photisms seem to have been neither a hindrance nor yet any particular help to the subject (apart from their use in discrimination, as above mentioned); yet they are pleasant, and add considerably to the enjoyment of music. That they are unequivocally conditioned by tones is evident from the fact that *M* never experiences colors of the kind in daylight, except when hearing music, and that they appear and disappear with the appearance and disappearance of the tones which call them up.

It may be further said that the phenomena are but one feature of a general mental tendency to rich and varied associative supplementing, which is exhibited, as will be shown later, by abundant personifications, metaphor and simile. The linking is obviously emotional. "This tone makes me 'feel' like this color." "When I try to feel like the letter C, I feel that it must be very pleasant and good-natured."

M has a generally keen and vivid visual imagery. She is able, *e. g.*, to analyze the color tones of grayish objects. Thus sand is not seen as silver-gray alone, but also as tinged with

[1] Bleuler u. Lehmann, Zwangsmässige Lichtempfindungen durch Schall, p. 49.

[2] This stamps Case I as belonging to the first type of Flournoy (Les phenomènes de synopsie, p. 9), in which the induced photism is objective.

blue and yellow and a little red. Oiled floors often have beautiful blues and reds. Her limen for the discrimination of gray figures in episkotister work is lower than the average. Nearly all shadows are colored. *M* has actually seen the "purple cow," —a red cow standing in a shadow which was bluish, in contrast to the yellow tone of the illuminating light. This tendency to analysis makes the subject see the landscape somewhat as an impressionist would paint it. As might be expected, colors have for her a high degree of affective tone—a certain corridor finished in browns is, for example, very depressing. This fact is of significance in view of the further fact that the photisms are conditioned by the affective value of the correlated sounds.

§ 2. *Experimental.*

(1.) *Retinal colors.* In order to differentiate the photisms from the retinal light, several series of tests were made, in which *M* was seated in a noiseless dark room. After a wait of several minutes, for adaptation, the changes in the visual field were telephoned to the experimenter in another room, who recorded them, together with their time of appearance and duration as indicated by a stop-watch. One such series will suffice.

TIME.		VISUAL PHENOMENA.[1]
MIN.	SEC.	
0	0	Very faint G.
0	20	G gone.
0	30	Dappled background of brightness.
1	00	Strip of B of high Satn.
1	05	Strip of B losing Satn.
1	35	Two strips of brightness in continuous slow movement,
1	50	One strip gone.
2	00	YG welling up.
2	10	YG gone.
2	30	Faint B.
2	35	Faint B gone.
2	45	Faint B back.
2	53	B changed to G.
3	10	G changed to YG.
3	18	YG gone.
3	33	Faint horizontal strip B.
3	55	B, high Satn. Pretty in spots. The rest as through a veil.
4	20	B spreading.
4	35	B lighter. Some G.
4	45	G more extended, greater Satn.
5	18	Eyes feel bulging and big.
5	55	Faint spot of B.
6	00	Spot of B and some G.
6	05	G, high Satn.
6	10	YG.
6	20	YG getting thinner and thinner.
6	30	More background.
6	45	Faint spot of B.
7	00	B gone.
7	30	G and B faint but very pleasant, in the form of a straggling S.
7	55	G and B, but spotted.
8	00	G.
8	05	G moving (as often, the color sweeps over the field, then closes up in a bunch, and disappears as if going down a spout).
8	35	B, ultramarine, surprisingly beautiful.
9	10	B moving away.

[1] The following abbreviations are used: Red—R; Blue—B; Yellow—Y; Green—G; Purple—P; Violet—V; Saturation—Satn.

TIME. MIN.	SEC.	VISUAL PHENOMENA.
9	15	G very faint, appearing above the B.
9	30	G light with B around the edges.
9	40	Mere background.
9	50	G very faint.

These colors are constantly shifting. Some (G and B) are very pure, corresponding to the standard saturation, and always luminous. Y and R are conspicuously absent. Y is never seen, except as a tinge in YG. R is experienced very rarely in the form of heliotrope, though not reported in the particular series just given. Evidently the assimilative retinal processes strongly predominate. When "no color," or "mere background" is indicated, the visual field is not a dead black, but something which is always described as a "mottled, muddy background." If a color tone extends or contracts, its saturation varies inversely with its extent.

(2.) *Photisms: (a) with simple noise and tone.*[1]

Noises, such as a single tap on the table, cause either mere winking or a general disturbance in the visual field. The darkness expands in waves from the center, as the ripples of water about the place where a pebble has been dropped. This is usually termed a "feeling of visual struckness."

Single tuning-fork tones. The vibration rates from 40 to 56 were given by Appunn's wire forks, held close by the ear; the rates from 128 to 1,152 by a set of Koenig forks on resonance boxes; those from 2,048 to 32,768 (?) by Appunn's high forks, actuated by bowing. The subject usually got a settled photism only after the upper partials had died away. Unless otherwise characterized, the colors are as described

[1] In the following experiments the subject was blindfolded and seated facing the source of sound. When after-images had disappeared the stimulus was given, preceded by the usual 'ready' signal. The stimulus lasted (except for noise) about ten seconds; at the end of that time the blindfold was removed, and the subject gave a detailed introspective report, picking the associated color from the six plates of the Prang *Standard of Color* (Popular Edition, No. 1, Boston, 1898). Although these color plates are too 'dead' to give exact representations of the photisms, some such classified and readily accessible scheme of color was felt to be serviceable not only for the publication of results, but also for avoidance of the large error (mentioned by other writers) of mere verbal description. Plate I of the *Standard of Color* contains seven horizontal rows of 24 colors each. The upper row gives the 24 most saturated color tones, ranging from red (R) through orange (O), yellow (Y), green (G), blue (B), and violet (V), to the purples (V R V, R V and R R V). The intermediate tones are lettered by combinations: *e. g.*, very blue violet (B B V), blue violet (B V). Below this upper row there are six rows giving graded 'tints' of the saturated colors of the upper row, row six being palest. This scheme of Plate I is repeated over again in each of the six following plates (II-VII), except that the whole plate is successively dulled or "broken" by the addition of black. Plate VII is, therefore, the darkest.

above, cloudy diaphanous forms projected before the face. It will be noted that the noise of striking the Koenig forks gave a visual disturbance similar to that caused by tapping upon the table. The colors are quite spontaneous, and usually surprises to the subject. They have the brilliancy of transmitted light through colored gelatines, and not the deadness of reflected colors.

TABLE I.

Single Tuning Forks.

r.		COLOR.		INTROSPECTIVE REPORT.
NOTE.	VIB.	PLATE.	QUALITY.	
E_1	40	V.	B	Surprised. Aroused verbal "mosquito." Horrid tone. The blue gray went through my head from one ear to the other.
G_1	48	V.	YYO	
B_1	56	—	——	Movement in visual field. Tone unpleasant.
C	128	I.	G	A very pleasant, luminous green seen through black. Not like any 'material colors'. Only came after upper partials had died away.
c^1	256	I.	G BV	Striking caused a flash of brightness. Then a green veil spread for a moment over the whole field. Next a horizontal strip of B V which spread out and got thinner till the tone ceased. The tone was pleasant.
d^1	288	IV.	VRV	Lasted exactly as long as r.
e^1	320	—	——	Striking gave 'visual movement.' No color as tone was not specially pleasant; not big enough.
f^1	341.3	I.	G_4	As seen through black veil. Tone quite pleasant.
g^1	384	I.	B_3 BBG_4	
a^1	435	I.	GYG_3	Appeared with the tone, but persisted slightly after it had stopped.
b^1	480	—	——	'Struckness' only. No color as tone was somehow indifferent.
c^2	512	I.	G_2	
e^2	640	I.	RV R	These colors were not seen projected, but merely 'suggested.' R was nothing but verbal "red." Surprise at pitch of r being considerably higher.
e^2	640	I.	GYG_4	
g^2	768	I.	YYG_3	Color got clearer and more saturated as the tone cleared.
—	896	I.	BBG_6	
c^3	1012	I.	G_4	Very, very thin color.
d^3	1152	I.	VBV_2	Visual movement and a "suggestion" of the violet.
e^3	1280	I.	VRV_1	Striking caused a momentary flash of green, then the violet appeared in a wide horizontal band, which contracted and became more saturated as the tone cleared.
c^4	2048	I.	YYG_3	Sour, horrid, unpleasant tone and color.
g^4	3072	I.	B_3	Tone less unpleasant. Color fairly pleasant.
c^5	4096	I.	YYG_4 Y_4	YYG_4 seen through Y_4. Color unpleasant. YYG grits the teeth. Tone shrill and unpleasant.
g^5	6144	—	——	Tone very horrid.
c^7	16384	—	——	
g^7	24567	—	——	
c^8	32768	—	——	Chills.

(*b.*) *Fusions.* Table II gives the photisms resulting from various tuning-fork fusions. Many of the combinations were repeated at different points in the series, but are grouped together for convenience. It will be seen that there is very little constancy in the reactions, but this is to be expected in view of the emotional link which forms their basis.

TABLE II.

Tuning Fork Fusions.

r.	COLOR.		INTROSPECTIVE REPORT.
	PLATE.	QUALITY.	
c^1–c^2	—	——	'Struckness.' Opening of the darkness.
c^2–c^3	I.	GYG / BBG	BBG seen behind GYG.
c^2–c^3	—	——	
c^1–e^1	—	——	Field got surprisingly and intensely black.
c^1–e^1	I.	GYG—G	Between the two. At the last began to get bluer.
c^1–f^1	—	——	Simple struckness.
c^1–f^1	I.	GYG—G	Between the two. A pleasant fusion.
c^1–g^1	I.	GYG_1	
c^1–g^1	I.	BBG_3	This was seen only with the left eye! Very unpleasant and quite unexpected to feel it so.
c^2–c^2	—	——	
c^2–e^2	IV.	BG_4	(Fusion given much more intensively.)
c^1–d^1	—	——	
c^2–c^3	—	——	

Table III gives the photisms resulting from the same fundamentals given simultaneously upon the piano. The experiment was intended to test the influence of the greater complexity of the resultant tone compound and of the piano 'color' upon the visualizations.

TABLE III.

Piano Compound Clangs.

r.	COLOR.		INTROSPECTIVE REPORT.
	PLATE.	QUALITY.	
c^1–c^2	—	——	Nothing at all.
c^2–c^3	—	——	Struck feeling only.
c^2–c^3	II.	B_8	And struck feeling also.
c^1–e^1	—	——	Struck feeling very plain. The visual 'opening' was complex as though several pebbles (three?) had been thrown into water.
c^1–e^1	I.	G_4	
c^1–f^1	III.	B_8	But even paler than this.
c^1–g^1	—	——	'Struckness'.
c^1–d^1	I.	GYG_4	'Struckness' followed by the color.
c^2–e^2	II.	B_8	
c^2–e^2	II.	GYG_6 / B_6	Very indefinite.
c^2–e^2	—	——	'Struckness'. Rather unpleasant.
c^1–d^1	I.	GYG_4	'Struckness' followed by the color.
c^1–d^1	II.	B_8	Quite unpleasant.

Comparison of Tables II and III shows a tendency to less saturated colors with the piano clangs. No color in Table III is assigned a place above row 4 in the chart, and most belong to plates darker than Plate I. The piano clangs were not so pleasant as the tuning-fork fusions. That this difference is due to the piano timbre rather than to the more complex nature of the auditory stimulus is shown by Table IV.

(*c.*) *Church organ.* Through the kindness of Mr. G. M. Chadwick, the University organist, we were able to try the effect upon the pho-

tisms of the various pitches in the varied tonal colorings of the different organ stops. The colors thus seen are much richer and more abundant than those obtained either from piano notes or phonographic selections.

For the sake of uniformity the same chord c-e-g was played in every instance, and was held until the subject announced the photisms clearly set,—usually about 5 seconds. This series was taken under slight fatigue which, contrary to the opinion of Flournoy, hinders rather than favors the photisms.

TABLE IV.

Church Organ.

STOP.	LENGTH. FEET.	COLOR.		INTROSPECTIVE REPORT.
		PLATE.	QUALITY.	
Bourdon,	32	—	—	
Bourdon,	16	—	—	Movement of the background from left to right.
Open Diapason, Pedal,	16		VRV	Solid heavy color.
Violon,	16	I.	G_8	
Full Pedal A,	16	—	B	Went in waves. Pleasant at first.
Contra Gamba,	16	I.	BBG_3	
Gamba,	8	I.	G_1	
Open Diapason,	8	I.	YYG_3	
Melodia,	8	I.	BBG_1	Very pleasant tone and color.
Great Diapason,	8	I.	G_3	
Violina,	4	I.	YG_4	
Violina (Octave lower),	4	I.	GYG_1	
Octave (Principal),	4	I.	YYG_4	Color unpleasant. Tone too shrill.
Fifteenth,	2	I.	G	Shivering clouds of G. Very thin. Located in top of head.
Vox Celeste and Octave Coupler,	8	I.	VBV	Both color and tone very pleasant.
Vox Celeste, Coupler, Violina and Contra Gamba,	16, 8, & 4	I.	VRV	Very luminous.
Concert Flute,	8	I.	YYG_3	
Flute d'Amour,	4	I.	G_3	Luminous color. Very pleasant tone.
French Horn,	8	I.	BBG_1	
Oboe,	8	I.	V	In a horizontal streak. This often occurs with V.
Cornopean (Small Trumpet),	8	I.	YG_3	Not so pleasant as Oboe.
Clarinet,	8	I.	BBG_4	But 'sharper' than this color.
Contra Fagotta (Clarinet bass),	16	III.	ORO	
		II.	VBV	
Contra Fagotta (an octave lower),	16	—	—	Mere roughness.
Cor. Anglais,	8	I.	GYG_4	Very clear.
Trumpet,	8	I.	YYG_3	Not very pleasant tone or color.
Clarion,	4	I.	Y_3	Clearer tone than Trumpet.

Table IV shows that the photisms developed by organ tones are 'clearer' than piano photisms, but 'paler' than fork photisms.

(*d.*) *Successive fork tones.* In these experiments two or four forks were hit successively at intervals of about three seconds, and then the resulting fusion was allowed to run for ten seconds. Usually each tone (especially when two forks were used) aroused its own color; during the tonal fusion these colors would intermix (not fuse) like two paints

stirred together upon a palette. Table V contains the results. Where two tones and two colors are given the first color is to be assigned to the first tone.

TABLE V.

Successive Fork Tones.

TONES.	COLOR. PLATE.	COLOR. QUALITY.	INTROSPECTIVE REPORT.
c^1, c^2.	I.	YG_2 / BBG_2	During the fusion the two were intermingled yet each was distinct.
c^1, c^3.	I.	RV_2 / YYG_4	YYG_4 appeared and persisted much higher, spatially, than RV_2.
c^2, c^3.	I.	BBG_1 / G_4	Expected that the colors would fuse, but they did not, though less separate than in the preceding test.
c^1, e^1.	I.	— / RV_1 / YYG_6	The fusion was RV_1 seen through YYG_6. First note gave nothing. The second the RV_1.
c^2, e^2.	I.	YG_2 / B	Intermingled during fusion, but still distinct.
c^3, e^3.	I.	B	Very thin and faint. Came with 1st tone.
c^1, d^1.	III. / II.	YYO_1 / YYG_2	Intermingled, giving an unpleasant, muddy effect. Surprised at low tones.
c^1, f^1.	III. / II.	RRV / GBG_2	Colors more separate during tonal fusion than with the c–c or c–e fusions.
c^1, g^1.	I.	B_1 / G_2	
c^2, g^2.	I.	YG_2 / —	Nothing with the second tone, probably owing to lack of attention.
c^1, e^1, g^1, c^2.	I.	B_1	Blue appeared only when all had sounded. Surprised not to have other colors.
c^2. g^1, e^1, c^1.	I.	G_4 / B_1	G_4 came with the first tone. It changed to a very luminous B_1 when all had sounded.
c^1, f^1, a^1, c^2.	I.	GYG_4 / B	Whole chord gave bright B in the middle of GYG_4.
c^2, a^1, f^1, c^1.	I.	G_1 / B	Both thin and floating over the dark background.

(*e.*) *Continuous Tone Change.* This form of stimulus was supplied by Stern's blown bottle apparatus. The range was from 224 to 308 vibrations, *i. e.*, a movement of 84 vibrations, which was traversed in 42 seconds, or at the rate of 2 vibrations per second. This experience was rather unpleasant to *M*, and the induced colors were correspondingly rare, and when present usually of an unpleasant yellow-green quality.

Moving up produced in the first test B G, which changed to G B G, and finally to G Y G. This test was fairly pleasant. A second test gave no color at all; a third induced, only near the close, Y Y G_2 modulating into a faint Y_3.

Moving down produced in the first test, at the start, no color; then Y Y G, and finally Y G. It was quite unpleasant. The second test started at Y_2, which faded into black. Next Y G_3 appeared, and faded into black, and finally B G_2 came.

(*f.*) *Intensity.* As to the effect of intensive variations upon the subject's photisms, it was found by general observation that on the whole greater intensities produced more saturated and more luminous, but rarely, if ever, more extended colors. Specific tests were made with

the f^1 tuning-fork. It was struck by a wadded hammer, and the tone allowed to die away. It aroused a very luminous strip of violet, which became more saturated and brighter as the tone cleared. The dying away of the intensity from this optimal point, at which the partials have just ceased, was correlated with a spreading and thinning of the photism. In a second test the fork was suddenly brought close to the ear when it had nearly died away. The photism and its changes were exactly like those of the first test, except that the sudden intensification increased the saturation without altering the extent of the violet. A third test, exactly like the second, induced a yellow-green light which behaved in similar manner to the violet of the second test.

(*g.*) *Musical Selections.* These were given upon the piano, the phonograph and the church organ, under essentially the same conditions as the preceding tests. As would be expected, the induced visualizations were more complicated and more irregular than those experienced with single tones or chords. The church organ aroused richer colors than the phonograph, when the same selections were heard on each during the same hour; but the phonograph, when removed from this 'dulling' effect of contrast, afforded as rich and pleasing colors as the organ: everything depended upon the emotional effect at the time. All the phonograph selections were repeated at intervals from a few seconds to several months. The results of immediate repetition are as likely to be divergent as those of repetition after the lapse of a considerable time.

1. *Piano.* "The Two Roses" played in the key of a (220 vibs.), gave Plate VI, R R V, vertically on the right side of the field of regard, and Plate VI, B on the left side. At the highest point reached by the melody, there arose Plate II, O Y O_4.

The same selection, played one octave higher (a-440 vibs.), was less pleasant; it gave as photisms Plate IV, B_4 in moving clouds, and some Plate IV, G_3, which slowly came and went.

2. *Phonograph.*

1. *Bridal March from Lohengrin* (brass band). The notes seemed to be separately visualized, each instrument being represented by countless little light points which moved in and out with their rhythm. Later, some Plate I, G and B appeared, which also fluctuated with the time.

The same selection, repeated five weeks later, gave indefinite and grayish colors, Plate III, G_2, B_2, and R_2. A tremolo effect roughened the colors. The horns aroused Plate I, Y Y G_2 and Y G, colors which seemed bitter to the subject.

The same selection, a few minutes after it had been heard on the church organ,[1] gave Plate I, Y G and B, not very pretty, unsteady, and spotted with black.

2. *Intermezzo from Cavalleria Rusticana* (orchestra), a very highly pleasing selection, gave extremely vivid and complex colors, all in Plate I. At first there was a very solid G, shifting to B, in which there were occasional flashing specks of O. These colors were in the upper visual field. Toward the end, where the trombone bass was prominent,

[1] See below, p. 388.

there appeared a very rich R R V or R V in the lower visual field. The high repeated attacks of the violins in this part gave B_3. The visual experience was very pleasant, but the auditory more so.

Five weeks later the same piece aroused Y[1] with the violin passage of the introduction, immediately succeeded by B and G and some Y_3. At the end R R V_2 appeared below the others, as in the first experience. After listening to it on the church organ, the *Intermezzo* on the phonograph gave G, B, Y (with the high violin passage) and V B V (with the trombones).

3. *Pilgrim Chorus* (band) induced R_4 for a short time, also R R V_4, B B G_4, G_3 and Y_4 (with a high note). These colors were less vivid than those aroused by the *Intermezzo*, more vivid than those of the *Bridal March*, but not especially pleasant to see.

Four weeks later it induced G, Y G_2, R R V_3, and B_2 on Plate I; B_1, B G_2, R R V_2, and O_2 on Plate III. The higher notes aroused colors higher in the visual field, together with eye strains of glancing upward. The trombones and bass horns aroused the R R V photisms. After the church organ the *Chorus* gave Y_1, R V_1, G Y G_1, 2, 3, and B B G_1, 2, 3.

4. *March from Carmen* (orchestra). A very vivid G appeared with the sound of the cornet and piccolo, and vibrated when they played a rapid staccato time; with other instruments (perhaps strings) appeared Plate II, R V_3, and jumping splashes or spots of Plate II, Y_2.

A few weeks later the subject experienced with this march a sudden flashing of the colors, chiefly G, at the first sound of the music. Throughout the selection, which is very exhilarating and accentuated in character, the whole visual field vibrated with the music, even the background taking up the movement when the colors were faint. The color-clouds were Plate IV, G, B, and B_1, and Plate III, G_1. Once there appeared a rainbow effect,—straight bands of R, G and B stretching across the field.

After the church organ *Carmen* occasioned merely faint greens and blues. An accidental pinching of the rubber ear-tube during the experiment brought about a sudden closure of the visual field and total disappearance of the photisms.

5. *Yankee Doodle* (banjo with piano accompaniment) produced dull, 'dead,' solid colors, a sort of background,—and not at all pretty. These colors were dark greens, blues, and yellows, which kept beating in the background with the twanging of the banjo, like little hammers hitting against the field.

This general setting was repeated in the photisms for the same selection a few weeks later. At the sudden loud start *M* winked, and the visual background jumped and stirred. The colors were at first indefinite, but throbbing distinctly in time with the banjo. Then they became more intense, taking on a striped appearance instead of the usual vaporous clouds. There were about six stripes of alternating Plate IV, R_3 and Plate IV, B_1. When the piano took up the melody it appeared visually as Plate II, Y Y O_2.

6. *I Fear No Foe* (bass solo with piano accompaniment). This song was distasteful to *M* because she did not like the voice of the singer. The colors were dull, rough and dead, like those of Plate VI of the Color Standard. The lowest note reached gave R R V of Plate VI.

The second hearing furnishes a good illustration of the emotional type of associative supplementing. While the colors obtained vary radically from the above they are still faint, dull and unpleasant. They were G Y G_3 and G B G_4. The very low note this time induced a thin green overlaid with an unpleasant brown.

[1] When no plate number is assigned Plate I is to be understood.

7. *Sally In Our Alley* (tenor solo with piano accompaniment) was pleasanter than the bass solo. It occasioned G Y G_3, G_4, G B G_3 and B_6. The turns produced a visual figure like a twice coiled spring.

8. *Grand March from Tannhäuser* (band) was, except in the fatigue test to be mentioned later, tried only after it had just been heard on the organ. On the phonograph it gave B, G, R R V, and flashes of brightness.

2 a. *Projection Experiments—Phonograph.* These tests differed from the preceding in that the eyes were open and looking, though without steady fixation, at a large black or colored screen hung about 20 cm. before the face.

I. *Black Screen.* Simply staring at the black screen for a length of time equal to that consumed by the musical selections gave Plate II G_3 (trembling like a drop of water), Plate I G Y G_4 (in a band) and Plate I B_4 (in the upper part of the field). These colors were all exceedingly faint and distinctly different from those projected by the music.

The *Bridal March* caused suffusion of the dead black with the following colors: R V_2, R V_3, V B V_2, B_4, and G Y G_4. They were not so strong as those seen with closed and bandaged eyes, and constantly changed. The reddish violet appeared in the form of a half-arch, about 15 cm. high, leaning over to the right.

II. *Red Screen.* Without the music no other colors appeared on the screen.

The *March from Carmen* induced photisms described as very thin veils through which the strong red background could always be seen. Y was quite frequent; a rather stronger B less frequent. This B made the area of the red on which it was projected appear V B, but the two colors were analyzable into the red background and the blue "veil." There was an occasional green. The B came with the horns and lower passages; the G and the Y with the higher passages.

III. *Green Screen. Grand March from Tannhäuser.* The principal veiling was yellow. A particular feature of the music induced a blue, which at one place narrowed into a small but quite thick and satured strip.

Green alone was seen without auditory stimulation.

IV. *Yellow Screen. Intermezzo from Cavalleria Rusticana.* The only projection observed was a faint horizontal blue strip which was correlated with the trombone, and which descended step by step down the screen with the descending trombone passages. Without music there were no projections.

V. *Blue Screen.* The *Intermezzo* repeated here caused a great deal of green, a single fleeting dirty yellow, and again a descending photism correlated with the trombones. This was a blue-violet effect, during which the blue background lost nearly all its saturation. Here, also, auditory stimulation was required to produce projected colorings on the background.

3. *Church Organ.* These selections comprised a repetition of the

principal phonograph pieces and, in addition, three pieces which had aroused photisms for *M* during organ recitals given by Mr. Chadwick.

A slight fatigue on the day selected for the experiment somewhat reduced the brilliancy of the photisms. They were, however, as already pointed out, more brilliant than those aroused by the same selections on the phonograph during the same hour.

Handel's Largo, the first of the extra pieces, was rendered with diapason and melodia stops in the introduction, and with melodia, concert flute and small diapason as the solo stop. The introduction was seen as G B G, B B G, and V B V arranged above one another in horizontal bands, the solo stop as Y G. Besides this, V and V R persisted throughout. Both the music and the colors were 'sweet' and very pleasant.

A *Chorale* was next tried, with a 'round'[1] stop setting, with later a sudden addition of reeds and mixtures[2]. The round stops induced blue; the addition changed this to green. The same selection was repeated, except that the full organ was added. This addition occasioned a burst of vivid green.

Chopin's Funeral March was colored Y G. Here again the sudden addition of the full organ was correlated with a luminous green, which burst close to the eyes.

The effect of the rendition of the standard phonograph music upon the church organ is given in Table VI. These photisms may be compared with those already mentioned as occasioned by the phonograph during the same hour.

TABLE VI.

Church Organ.

SELECTION.	COLORS AND INTROSPECTION.
Pilgrim Chorus,	With the violins a very luminous BBG_3; with full orchestra effect YG over RV. At other times B and G.
Grand March,	Mostly VRV_1 and G. Also G_1, G_2, G_3, and B_4. All the colors thin.
Intermezzo.	VRV, V, G, and a very high, pretty and luminous B_5. The colors all shivered and trembled (owing to the influence of the Vox Celeste and Tremolo stops).
Bridal March,	A predominance of blues, and also RV_2, VRV, G, and YG.

(*h.*) *Centrally Excited Photisms.* Several deliberate attempts were made to induce photisms from centrally excited melodies. Although the process of imaging the music was pleasant, no photisms could be secured. The pieces attempted included popular airs and some of the phonographic selections used in the previous experiments. Careful observation also has failed to disclose any colorings in centrally excited music at any time in the subject's life.

(*i.*) *Fatigue.*[3] Other authors have asserted that fatigue tends to pro-

[1] *I. e.*, melodia, flutes, etc.
[2] Full swell organ, coupled with octaves.
[3] These results were so constant that details may be omitted.

duce greater frequency and brilliancy in synæsthetic phenomena. In order to test this a successive fork series and four phonograph selections were given to the subject when she was in a state of considerable fatigue. The results showed that the music was then soothing and restful rather than exhilarating in character. The photisms were *not quite so frequent*, and though pleasant were almost invariably *much paler*, corresponding to the 3rd, 4th or 5th rows of the Color Standard plates.

(3.) *Photisms with other Senses. Taste and Smell.*

Before these tests the subject had never experienced colored taste or colored smell, and felt confident that no colors would be aroused. The results showed, however, that both these photisms were present, though in much less developed form than the others. The colors were always rather slow to appear and were flatter, deader, more like reflected light, than those with sound.

(*a.*) *Taste.* The results with tastes tried upon two occasions nearly a year apart, are not very concordant. Certain features of them will be found, however, to exhibit very close similarity with the taste-colors of Case II, later to be mentioned. The solutions were sugar 20%, salt 2%, tartaric acid .5%, quinine (hydrochlorate) .2%. Enough of each solution was taken to cover the whole tongue.

The following results were obtained in the several trials:

Sweet. (1.) No color. Taste was pleasant at first then sickening.
(2.) No color. Taste not recognized at first. Called up verbal "cool" and "high."
(3.) GYG_3, B_2, and GBG_2. The first was a line only; it spread out, growing bluish. The taste was not very pleasant.

Acid. (1.) YYG_2. Shivered, drew up whole body. Mouth puckered. A clean taste.
(2.) YYG_2 and associated visualization of some green grapes picked in childhood.

Salt. (1.) No color. Very unpleasant.
(2.) BBG. Taste quite weak.

Bitter. (1.) O_3. Over a blackish background.
(2.) YG_2. Tastes like some kind of medicine.

Sweet and Acid. BBG_4. This color was not projected at all, and was rather a 'suggested' color.

(*b.*) *Smell.* Although the subject's sensitivity for odors is quite poor, colors were very certainly incited by smell stimuli. They appeared at about the second inhalation, and lasted till the stimulus was removed. The following results were taken one week apart, each odor thus being twice tested.

1. *Wormwood.* (1.) Very faint red. Vague visualization also of a flower.
(2.) Yellowish green. Neither odor nor color pleasant. Visualization of a brook and dusty green peppermint growing beside it.
2. *Cinnamon.* (1.) Very faint green. Smell seemed cool at first, then warmer.
(2.) Warm blue. Smell was pleasant and warm.
3. *Asafœtida.* (1.) No color. A clean 'hospital' smell. Visualization of rows of beds.
(2.) No color. A cold smell. Same 'hospital' complex plus a doctor with gray hair.
4. *Anise.* (1.) Faint reddish-violet. Quite pleasant.
(2.) Green. And then a visualization of green pickles, also a store, and a woman by the pickle barrel (a childhood scene). Pleasant but funny smell.
5. *Camphor.* (1.) Ice green photism, and visual and auditory "camphor."
(2.) Faint but pretty pearl gray, and later saw a dentist. The dentist was unpleasant, but the smell was clean and pleasant.

6. *Crab Apple Blossom.* (1.) Small faint green photism. Then a visualized candy store of childhood.
(2.) Very faint green, undulating and pleasant. Visualization, a scene from a book she had been reading of a room in a country house, all hung in white—muslin curtains blowing in the breeze and lilacs upon the table.
7. *Bisulphide of Carbon.* (1.) Dark orange brown with light gray in it. Very unpleasant.
(2.) Sickly orange yellow. "Very horrible" color and smell.
8. *Wood Alcohol.* (1.) No color. Visualization, a physician. Smell was at first sniff unpleasant, then became pleasant.
(2.) Green. Pleasant. It has some very strong association, but can't get at it.
9. *Rose.* (1.) No color. Odor very faint and cool. Visualization, a garden with shady green walks.
(2.) No color. The smell was unknown. Very pleasant. It aroused a verbal "choir invisible" and a visualization of the dainty lady who was like "Rosemary and faded rose leaves, between the sheets of old music."

(4.) *Miscellaneous Synæsthetic Phenomena.*[1]

M has no phonisms, and no visual forms for numbers, days, months, etc. She visualizes additions, multiplications, etc., only as numerals. The only other phenomena analogous to those described are the personifications given to numerals, letters, and inanimate objects, and the converse tendency to see resemblances between persons and other things animate and inanimate. Thus, for example, one person appeals to *M* as a log of wood, another as a toad, a third as a mosquito, a fourth as a walrus.

Personified numbers and letters are not usually visualized as persons, but endowed with human characteristics. In childhood, 7 was unpleasant, cross, always fighting with 8. The two were, unfortunately, too close together. 5 is a pleasant number, 3 very unpleasant.

There remains to be mentioned the coloring of words and individual letters. Excepting the auditory word "horn," which is orange yellow from the color of brass instruments, and an occasional associative supplementing of especially affectively toned christian names—such as Bernice,—blue,—the subject never has photisms with words.

Individual letters are never heard or seen as colored. The following list contains a list of colors which seemed to the subject what they *ought to be* and *must be*, if they have any color at all. On the other hand, the affective tones and the personal characteristics of the letters are quite real, and in some cases very vivid and decided. The entire alphabet was canvassed twice. The second time was nearly a year after the first, so that it is but natural that many of the reactions differ. In fact they might, according to the subject, be different from day to

[1] Many writers have pointed out that colored hearing is often associated with number forms, personifications, etc. Flournoy, *op. cit.*, p. 14. Calkin's, Experimental Psychology, at Wellesley College. This *Journal*, V, p. 260.

day. In general, *M* visualized a printed capital letter, and then thought for 10 or 15 seconds before announcing the report, in order to feel herself just like the letter in question.

TABLE VII.

Alphabet.

TER. LET-	AFFECTIVE TONE.	COLOR.	OTHER CHARACTERISTICS.
A	Pleasant,	Red,	
A	"	——	
B	Less pleasant,	Blue,	
B	Neutral,	Blue,	Fat.
C	Unpleasant,	Greenish yellow,	
C	Very pleasant,	Green,	Good natured.
D	Unpleasant,	Brown,	Stupid.
D	——	——	Nice, happy, jolly, fatter than B. A man with red cheeks, bright eyes, hopping around with his hands in his pockets.
E	Pleasant,	Reddish,	
E	Neutral,	——	
F	Unpleasant,	Green,	
F	——	——	Rough. A log of wood.
G	——	Dull bluish green,	
G	——	——	Unhealthy.
H	Pleasant,	Something rich,	The width is pleasant.
H	——	——	Feels aristocratic but is n't.
I	Less pleasant,	Thin yellow,	Thin.
I	——	——	Like Uriah Heep.
J	Unpleasant,	Yellow green,	Ugly.
J	"	" "	Not nice. I don't like it. Never have much.
K	——	Cold blue,	Hard (sound).
K	——	——	Has been an outsider in the letters, but is now trying to get along with them.
L	Pleasant,	Reddish,	But less than A.
L	"	Blue,	Refined, quite nice. A very elegant person.
M	Very pleasant,	Violet,	Liked because it is my initial.
M	——	——	" " " " " Quite nice.
N	Pleasant,	Bluish,	
N	"	——	Agreeable.
O	"	Something rich and extended,	Generous.
O	"	Yellow,	Jolly and full of fun.
P	——	Green and dirty brown,	Mean, selfish.
P	——	——	Dignified and a little conservative. [rano.
Q	Pleasant,	——	Bizarre. Fine qualities under it. Like Cy-
Q	——	Yellow green,	A genius. Erratic and unusual.
R	Pleasant,	Rich green,	
R	——	——	Ordinary. Not neat. Like a woman who dresses in second-class style, but puts on the airs of the first-class.
U	——	——	Disappointing. Attempts to be a beautiful red, but falls short of it. [natured.
U	——	Orange (?),	Happy. Stout, but not like D, not so good
V	——	Dark gray,	Dignified.
V	——	Delicate blue,	Aristocratic. Very dignified and feminine.
W	Pleasant,	Red and purple,	Jolly. "Hail fellow well met." [thrift.
W	——	——	Generous. Good hearted, and yet a spend-
X	Unpleasant,	Green,	[to be one.
X	——	Rough blue,	Like an ordinary working man who tries not
Y	——	Dark gray,	Dignified.
Y	Pleasant,	Blue,	Like music.
Z	"	Yellow and green,	
Z	——	——	

For further general remarks upon Case I, see the final résumé.

Case II.

§ 1. *Historical.*

The subject of the second case is *R.* (Mr. E. C. Roberts), an undergraduate student of the arts department. *R's* father is musical. He himself is fond of music, and both plays and sings. At the age of 15, he read an article on Colored Hearing in a paper, and then noted that he had associations of color with tones, tastes, and temperatures.[1] In spite of discouragement from members of his family he continued to observe the photisms, and found a good deal of pleasure in determining the correlations. At the same period he noted phonisms of pain. These, however, were not prominent until the summer of 1899, when a badly injured finger gave occasion for a series of determinations of the 'pitch' of the pain. *R's* colors differ radically from *M's*. They are but rarely vivid enough to be projected,[2] yet they are very detailed and very constant. *R* uses the word "match" to describe the relations of the correlated sensations.[3] That the color is, however, consciously present, and not a mere verbal association, is evinced by the discriminating manner in which *R* chooses the color tone from the Prang plates, and further by the fact that in the process of 'matching' a certain color tone and only one in the chart 'affects' him just as the sound did. Despite the use of this word, the link which forms the basis of *R's* synæsthesia does not seem to be an *affective* link. As a rule, the whole process is indifferent.

§ 2. *Experimental.*

The following tests, with the exception of the Galton whistle and of the experiments upon phonisms, are duplicates of those already mentioned.

(1.) *Retinal Colors.* The following list shows that the dark-room visual phenomena of *R* are essentially similar to those of *M*. The 'nothing' reports indicate merely absence of coloring; the field during these periods is generally disturbed by spots, lines, and mottlings of gray. The "dull blue" is Plate VI, BBV, the dull green Plate IV, YYG, the bright blue a luminous Plate III, B.

TIME.		VISUAL PHENOMENA.
M.	S.	
0	0	Muddy G.
0	20	Dark B.
2	45	Dull G.

[1] The plunging of the hands into cold water, *e. g.*, was always 'red.'

[2] All colors which are projected are indicated in the Tables by an exclamation point.

[3] Oddly enough, both types may be present, and the colors projected may be dissimilar to those which would be 'matched' or 'assigned' to the stimulus. See Table IX, Second Test.

TIME.		VISUAL PHENOMENA.
M.	S.	
3	00	Dull B.
3	15	Nothing.
4	00	Faint brightness.
4	35	Very dull B.
5	00	Gray and G. Well defined patterns.
5	20	Brighter gray.
5	50	Nothing.
6	18	Dull B.
6	40	Nothing.
7	00	Dull B.
7	08	Dull G.
7	24	Brighter B.
7	53	Very bright B. } Uniformly spread and fringed with a zig-
8	10	Exceeding bright B. } zag green border.[1]
8	20	B.
8	45	Nothing.
9	35	Dull B.
9	55	Brighter B.
10	20	Momentary spots of very bright B.
11	50	Bright B.
11	55	Bright B in a cloud with a green border.
12	05	Bright G.
12	08	B.
12	20	G. Cloud spread over the B.
12	32	A succession of these colored clouds of different shapes.
13	08	Bright B spots on B ground.
13	45	Flash of G over the B ground.
14	10	B ground changed to black.
15	00	All black with one or two bright spots.

(2.) *Photisms: (a) with Simple Noise and Tone.*

Noises. A sharp rap on a table aroused a faint but distinct narrow flash of brightness, running from left to right across the field.

Single tuning-fork tones. One complete and one partial series are represented in Table VIII. The duplicate members were retaken after one month to test the constancy of the association. The prevalence of R and V—colors absent from the retinal lights—is noteworthy.

Tests with the Galton whistle gave a brightness streak, the inclination of which varied with the intensity of the whistle. Another series produced nothing but unpleasantness.

(*b.*) *Fusions.* Table IX gives the results of tests for the photisms of tuning-fork fusions. We were unfortunately not able to use the Prang chart for this particular series.

(*c.*) *Church Organ.* The test for stop effects gave with *R* the results in Table X. With a single exception these colors were matches. The rather light-gray tones assigned to the 32 and 16-foot stops is of interest in contrast to the idea generally prevalent that very low tones should be dark.[2] The clarion stop, which at the pitch used (circa 512 vibs.) gave G, turned through red to a brown-gray when the pitch was successively lowered by octaves. Neither *R* nor *M* shows any definite correlation of color and tonal register.

[1] A phenomenon of this sort is often seen (!) with organ music.
[2] Stumpf, *Tonpsychologie*, II, 526, 531.

TABLE VIII.

Single Tuning Forks.

r.		COLOR.		INTROSPECTIVE REPORT.
NOTE.	VIB.	PLATE.	QUALITY.	
E_1	40	II.	Y_5	Light copper color. Rather uncertain.
B_1	56	—	——	
c	128	I.	RO RRV_5	Changed to RRV_5 as the fork died out.
c^1	256	I.	RRV_6	
c^1	256	—	——	A dull gray.
d^1	288	I.	V_4	
e^1	320	I.	RV_2	
e^1	320	—	——	A dull red.
f^1	341.3	I.	RRV	
f^1	341.3	II.	R_4	
g^1	384	I.	RRV_1	
g^1	384	I.	RV	
a^1	435	I.	R	
a^1	435	I.	RV	
b^1	480	II.	R	
c^2	512	I.	RV	
c^2	512	I.	BV	
e^2	640	I.	VRV	
e^2	640	I.	BV	Quite bright. Saw a little cloud of white light go across the field when the fork was struck.
g^2	768	I.	V	
g^2	768	I.	B	
c^3	1012	I.	VBV	
c^3	1012	I.	B	B shading into G.
d^3	1152	I.	VBV	
d^3	1152	I.	B	Very clear B.
e^3	1280	I.	V	Very bright.
e^3	1280	I.	BV	
c^4	2048	I.	BG	
g^4	3072	I.	GBG (!)	Surprised actually to see this color.
c^5	4096	—	——	
g^5	6144	I.	VG_4 (!)	In splashes upon a dark background.
c^6	8192	V.	G_4	

TABLE IX.

Tuning Fork Fusions.

r.	INTROSPECTIVE REPORT.
c^1–c^2	Between reddish brown and coffee color.
c^1–d^1	Bright red gray, but also saw (!) little rapidly vibrating spots of light, mostly blue, which vibrated with the beating of the forks and described forms like Lissajou's figures.
c^1–e^1	Dull red.
e^1–f^1	Dull red.
c^1–g^1	Matches reddish gray, but also saw (!) a pale cloud of yellowish green. The two felt incongruous.
c^1–a^1	Rather bright pleasant red gray.
d^1–g^1	A pale red violet with gray. At the striking of the forks saw (!) little clouds of bright blue.
c^2–e^2	Bright blue-violet.
c^2–c^3	Pure violet.
c^3–d^3	Matches RV, but saw (!) an indefinite disturbance in the visual field.
c^3–g^3	RV not so bright as the preceding.
c^4–c^5	(c^5 struck slightly first.) With the first, saw (!) clouds of bright blue, with the second a cloud of greenish yellow. The two clouds remained distinct and appeared alternately.

TABLE X.

Church Organ.

STOP.	LENGTH.	COLOR.		INTROSPECTIVE REPORT.
		PLATE.	QUALITY.	
Bourdon,	32	VI.	R_4	
Bourdon,	16	VI.	R_5	
Open Diapason (Pedal),	16	II.	YO_5	
Violon,	16	—	——	Medium gray.
Full Pedal,	16	V.	RRO_5	
Contra Gamba,	16	I.	V_5	
Open Diapason,	8	II.	RO_1	
Melodia,	8	I.	RV	
Great Diapason,	8	I.	RRV	
Violina,	4	I.	BG	
Violina (octave lower),	4	I.	GBG_3	
Octave,	4	I.	R	
Fifteenth,	2	I.	G	Very solid G.
Vox Celeste and Octave Coupler,	8	III.	R_3	Muddy.
Vox Celeste, Coupler, Violina and Contra Gamba,	16, 8, & 4	III.	R	
Flute d'Amour,	4	I.	BV	Bright.
Concert Flute,	8	II.	RRO	
French Horn,	8	I.	G_2	
Oboe,	8	II.	R_1	
Cornopean,	8	I.	R	
Clarinet,	8	I.	R_2	
Contra Fagotta,	16	II.	RO	
Contra Fagotta (octave lower),	16	IV.	RO_4	
Cor. Anglais,	8	II.	R_1	
Trumpet,	8	II.	RRO_1	Saw (!) green spots.
Clarion,	4	I.	G	

(*d.*) *Successive Tones* (tuning forks). Table XI shows *R*'s coloring for successive tone complexes of three and four constituents. No pairs were tried. This form of stimulus was found to be decidedly pleasant; a fact which possibly accounts for the projected photisms in three out of the eight cases. All the colors are found in Plate III.

TABLE XI.

Successive Fork Tones.

T.	COLOR.		INTROSPECTIVE REPORT.
	PLATE.	QUALITY.	
c^1, e^1, g^1, c^2.	III.	VBV	This was the color of the whole complex.
c^1, g^1, a^1, c^2.	III.	VBV	" " " " " " "
d^1, g^1, b^1.	III.	RV R_1	b^1 was RV; the whole R_1.
b^1, g^1, d^1.	III.	BG BV	All seen (!) in the lower right hand corner. The fork is always 'placed' visually in the center of the field. (These tones were given rapidly and quite intensively.)
b^1, g^1, d^1.	III.	BG BV	The same projected visualization. (The tones were given less rapidly and less intensively.)
c^2, g^1, e^1, c^1.	I. III.	VRV RO	c^2 was RO, the complex VRV.
c^2, a^1, f^1, c^1.	III.	BG BV	f^1 was BG, c^1 was BV, both were seen (!). These colors coincided spatially with the 'placing' of the fork. Each fork when struck makes a flash in the field.

(*e.*) *Continuous Tone Change.* A steady tone of 224 vibrations was denominated Plate V, O_6, one of 308 vibrations, Plate II, V_4.

As the tone moved down from 308 to 224 vibs. the violet gradually shifted. First the blue faded out; then the red which remained became lighter and grayer till it reached the Plate V, O_6. *R* thought that if the tone had gone considerably lower it would have become clear white.

The moving up of the tone produced an exactly reverse effect, except that the entrance of the blue which carried the red over into violet was quite sudden. None of these colors were projected. This test well illustrates the greater uniformity of the photisms of Case II, as compared with Case I.

(*f.*) *Intensity.* The variation of *R's* colored hearing with the intensity of the Galton whistle has already been noted. The outcome of the other tests, with the f^1 tuning-fork, was quite dissimilar to that with *M*. A moderate intensity aroused (!) Plate III, B G_3; a weak intensity gave a brighter and smaller photism; and a strong intensity a more extended one. Silence is white.

(*g.*) *Musical Selections.*

1. *Piano.* The same tests were employed as with *M*. At the lower pitch *R* saw (!) red and green bands (Plate V, Y G and R R_0) at an angle of 60°. They appeared almost with the first note, and varied with the intensity of the music. At one place the angle of inclination changed slightly. At the higher pitch the same colors were seen (!), but in narrower bands and in a more vertical position.[1]

2. *Phonograph.* The musical selections upon the phonograph were at first quite unpleasant (owing to scraping sounds, and emphasis of partial tones), but after four or five selections, this affective reaction passed away.

(*a.*) *Bridal March* (1). No colors seen (!). Unpleasant. The prevailing color matches reddish brown (Plate III, RO), with green for the trombones.

(2.) Saw (!) a tube with flaring mouth sending out puffs of "music smoke" with the rhythm of the music. The 'matched' color for the whole selection is still a reddish brown, though clearer than before. (Plate II, RRO.) The music much less unpleasant.

(3.) Immediately after it had been heard upon the church organ,[2] the Bridal March occasioned no visualization, and matched Plate I, R. except the high violin part, which was RRV.

b. Intermezzo. (1) No colors seen (!). The color was bright red,

(2.) After the organ: matched RV with high violins B.

c. Pilgrim Chorus. (1) Slightly unpleasant, no association.

(2.) After the organ: saw (!) stripes of Plate III, R and Plate IV, G, arranged either in parallel oblique bands or in concentric arches piled one on another.

d. March from Carmen. (1) The whole selection matched Plate II, R. The flutes were of a very bright red.

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[1] This is a good instance of a feature of *R's projected* photisms. They tend to appear not as clouds or veils (as in *M's* case), but in rather detailed and specific forms, *e.g.*, as puffs of color from a 'tube' of definite size and inclination.

[2] See below, p. 397.

(2.) After the organ: the subject had the tubular visualization above mentioned, save that the faster time produced a narrower tube. Besides this he saw (!) one spurt of R, and G stripes, in the lower visual field.

e. Grand March. (1) This march aroused the same phenomenon as the Bridal March (2) and the Carmen March (2). Here the emitted 'puffs' became narrower and longer where the music was higher. The prevailing volume of the puffs, and hence the size of the tube, was in this march midway between the same dimensions in the other two instances.

(2.) After the organ: 'matched' Plate I, R.

f. Marble Halls (song from the Bohemian Girl, with piano accompaniment). The piano interludes were a bright violet, the singer's voice a very bright green.

g. Yankee Doodle matched Plate II, RRO.

h. I Fear no Foe was generally Plate III, G. The deepest notes of the singer's voice were YG of the same Plate.

i. Sally in Our Alley, a tenor solo, was assigned a brighter green (Plate I, YG).

3. *Church Organ.*

These tests included only four of the standard phonograph pieces. They are significant in comparison with the phonograph renderings heard during the same hour. The greater wealth and intensity of the church organ aroused actual projections of specific form, which are in marked contrast to the general sterility of the phonograph visualizations.

(1.) *Pilgrim Chorus.* This matched Plate II, VRVY. During the orchestral passage of descending 16th notes, the subject saw dropping rain. The violin and horn stops excited projections of broad B and narrow RRV stripes running obliquely upwards from left to right, the violin and fagotta stops similar projections running obliquely downward from left to right.

2. *Grand March.* Here R saw (!) concentric red and blue arches, and towards the close the phenomenon of smoky rings of brightness running up a tube in tune to the music.

3. *Intermezzo.* This was assigned a match,—horizontal strata of red and violet. There was no projection.

4. *Bridal March.* Again the 'puffing' visualization (!) was called forth. The 'angle' of the 'horn,' as in the piano selections, approached the vertical with the higher pitches. Finally a very high note made the 'horn' disappear in a momentary burst of colors (B, V, and Y).

(*h.*) *Centrally Excited Sensations.* In marked contrast to Case I is *R's* ability to obtain what he calls 'matches' from centrally excited sensations. An imagined sweet is as blue as the actual taste. His phonisms are likewise centrally excitable. Indeed, when he tried to rethink the pain of the injured thumb above cited, he found its 'pitch' much more available than its ache. After a few seconds' trial at the piano, *R* announced that this pitch was the discord of d^2 and e^2 simultaneously and faintly sounded.[1]

(*i.*) *Fatigue.* No laboratory tests upon the dependency of *R's* synæsthesia upon bodily fatigue were undertaken. He himself thinks,

[1] The reliability of this rather astonishing phenomenon is attested by the fact that *R* had picked out the pain of this injury several months before the above test was taken as starting out at a^2, and descending to d^2 as the pain lessened. He had forgotten the first test completely when the second took place. He does not know the piano keys by name

with *M*, that fatigue rather hinders than favors these experiences. Thus sleepiness prevented him from getting any colors at a certain organ recital at which he was anxious to observe colored hearing.

(3.) *Photisms with other Senses.*

(*a.*) *Smell.* *R* found few projected colors, when stimulated by odors, and the assignment of colors to smells was less natural, less spontaneous, than to tones. Especially, he often debated whether the color should be red or green. On the first day's trial, *R* suffered from a bad cold, and the stimuli were given in small bottles. The odors were thus in many cases too weak. On the second trial, the fluids were poured out into flat trays. The increased intensity sufficed to afford the following results.

TABLE XII.

Odors.

ODOR.	ASSIGNED COLOR.	SEEN COLOR.	FURTHER INTROSPECTION.
Camphor,	YG	——	Pleasant odor. Color doubtful.
White Rose,	RV	——	Very pleasant.
Carbon Bisulphide,	Dirty O	——	Unpleasant. "Take it away."
Crab Apple Blossom,	Clear Red Gray	Plate I. B	Very pleasant. The bright blue seen (!) was in the form of little lights, and was due to the odor. They were more pleasant than the "nice red gray" assigned, yet the "red gray idea" corresponds to "that odor idea."
Cinnamon,	——	Brightness,	A light cloud rising in the lower part of the field. "Sunrise on a small scale."
Anise,	R	——	Fairly pleasant.
Asafœtida,	B	——	Pleasant. Doubtful assignment,
Orange,	Deep R	——	Pleasant.
Peppermint,	RV	——	Pleasant.
Cloves,	RO	——	"Associated roast beef for some reason."
Oil of Citronella,	Deep unpleasant R,	——	Odor unpleasant.

(*b.*) *Taste.* *R* has always had colored taste along with his colored hearing. The laboratory tests were confined to the four standard solutions employed in Case I. The assignment of colors was subjectively considerably more natural and definite than for odors, and even than for tones, and was extremely uniform. The time which elapsed from the first introduction of a solution to the expression of its color was recorded by a stop-watch. This time approximated to 4 seconds. This may seem to give evidence of a deliberative form of judgment; but it must be remembered that some time was required for the spreading of the solution over the tongue, and an appreciable time for the functioning of the nervous processes underlying the sensation,—and further that *R* is generally slow in

expression. Moreover, his introspection bears out this assertion of spontaneity; *e. g.*, when salt was tried, the report was: "The color (R O_2) came as soon as the taste was nicely round my mouth. Then it gradually faded. This color is part of my 'salt consciousness' just as much as the name 'salt.' The color, the taste, and the name are parts of a whole, like the separate notes of a chord."

Table XIII contains results for each taste and for combinations of tastes obtained at three different times. The time of reaction is included in the majority of cases. Like tastes are grouped without regard to the day upon which they were tested. The only lapse from uniformity is the single instance of acid as red. This may be due to the fact that acid was unpleasant in this one trial.

TABLE XIII.

Tastes.

r.	TIME. SECS.	COLOR. PLATE.	COLOR. QUALITY.	FURTHER INTROSPECTION.
Sugar,	3.5	I.	B	r pleasant. A clear, bright B.
Sugar,	3.0	I.	B	r getting sickish. B still pleasant.
Sugar,	——	I.	B	
Acid,	4.0	I.	G to GBG	r pleasant after the first moment. Bracing. Recognized as acid.
Acid,	7.0	IV.	R_2	Acid, unpleasant. (Large mouthful.)
Acid,	3.5	I.	G to GBG	Pleasant.
Acid,	——	III.	GBG_2	Less bright than previous acid green, because r tasted differently.
Acid,	——	I.	BG	r not so biting as before,
Salt,	3.0	IV.	R_2	Pleasant, salt. A dull R.
Salt,	4.0	II.	RRO	" " " " "
Salt,	3.0	I.	RO_2	Color came as soon as the taste.
Bitter,	——	II.	RO	
Bitter,	10.0	II.	YO_2	Color a yellow brown. r too weak, hence the long time.
Bitter,	4.0	III.	RO	Pleasant, bitter. Color is a nice, dark brown.
Sugar and Acid,	4.5	III.	BG	A greener blue than with sugar. Recognized the two elements in the solution but not until the color had been assigned. (By mistake, the beaker had not been rinsed of acid. Sugar only was intended.)
Sweet and Salt,	7.0	IV.	B_1	r very unpleasant, sweet and salt. A dull, muddy blue.

Beside these photisms with the standard tastes, *R* assigns colors to many dishes; but their colors are often due to the actual color of the things themselves. Some of these assignments are given in Table XIV.

(4.) *Phonisms.* We have already mentioned an instance of tonal pain. A similar case occurred to *R* during experimentation. He suffered from a stiff neck, which 'sounded' like f^1 and g^1 simultaneously struck upon the piano. *R* had tried pressures at home, but not systematically. He thought he could have picked out piano tones to go with them.

TABLE XIV.

Dishes.

FOOD.	ASSIGNED COLOR.
Meats,	Dark yellow, dark red, and dark brown.
White bread,	Pale sickish white.
Graham bread,	Rich red.
Milk,	Light yellow.
Bread and Milk,	The color of a cup of cocoa.
Apples,	Some are Plate III, G. Other (riper) are reddish violet.
Peaches,	Rich dark red.
Bananas,	Light yellow.
Grapes,	Blue grapes taste reddish violet.
Ice Cream,	Chocolate or coffee ice cream is the brown which is assigned to bitter. All other ice creams are blue.
Cocoa,	Has no color, but if there were any match it ought to be like pale reddish violet light thrown on a brown screen. (This effect has never been seen by *R*, but he thought that it ought to be the proper thing.)

In the laboratory we found it easy to arouse in *R* mild clear tones of definite and determinable pitch with pain, pressure, and temperature stimuli. These tones were subjectively indistinguishable from the tones aroused by imaging or recalling music.

(*a.*) *Pain.* The algometer, pressed between the palms of both hands till pain was sensed, produced at 3 kg. d^1, at 5.2 kg. $b^{flat\,1}$. A pressure of 2 kg. on the sternum occasioned a pain equated to e^8, one of 2.1 kg. a c^4. After the hand experiments *R* involuntarily looked at his hands to see what the tone should be.

(*b.*) *Pressure.* Stimuli for pressure were obtained by the application upon the forehead (median area) of a single Griesbach æsthesiometer point, either with the rounded or the sharpened terminal. A preliminary series with the rounded terminal disclosed the fact that, within certain limits, duration of pressure was equivalent to intensity of pressure. Upon application of a given constant pressure a tone was at once heard which moved up steadily about an octave and a fifth during the first seven or eight seconds of the pressure. After this the tone remained upon the niveau which it had gained, for the remainder of the period of application.[1] Accordingly, a second series was undertaken in which that tone was recorded which corresponded to the pressure at the end of 10 seconds. In every case the tone had reached a level at the time judgment was pronounced. The subject picked out the tone from the piano, so that the error of recording cannot exceed a half-tone. He was especially cautioned not to confuse his estimation by an octave, and he felt confident that this error did not appear. In every instance in which the progressive tone series broke with the progressive pressure series, the apparent discrepancy was elucidated by the introspective report that the pressure actually sensed (owing to

[1] We did not experiment with any pressures of over 20 seconds.

irregularities in the sensitivity of the points stimulated) was a variation from the general progression of the series. Once a cold spot was excited, and no tone was heard. The highest tone given in Table XV (f^1) was louder than the others. In general, the tones were so mild that in order to pick them out, the soft pedal of the piano had to be kept down, and the keys to be struck pianissimo.

TABLE XV.

Pressures. (Blunt.)

r. GRAMS.	TONE.	REMARKS.
10	e^1	
20	f^1	
30	—	Struck a cold spot.
30	d^1	
40	a^1	
50	e^1	
60	a^1	
70	$b^{flat\,1}$	This pressure seemed to change suddenly at the removal.
70	b^1	(20 seconds pressure.)
80	d^1	r felt much less intense than the preceding one.
90	$c^{sharp\,1}$	
100	e^1	
110	f^1	

The lower tones ascribed to the last four pressures are due to a lessened sensitivity, probably from general or local fatigue. The tones were all localized at the point of application of the pressure.

The sharpened terminal was applied on the same forehead areas with pressures of from 10 to 50 grams. The stimuli, as Table XVI shows, were generally painful, especially at the first moment of application, when *R* often involuntarily shrank away from the point. The tones, though louder than those of Table XV, were still mild and pleasant, with the exception of one discord which the introspection entirely explains.

TABLE XVI.

Pressures. (Sharp.)

r. GRAMS.	TONE.	INTROSPECTION AND NUMBERS.
10	a^2	Tone fairly loud, pure and pleasant. Pressure slightly painful.
20	a^2	Slightly painful when first felt.
30	d^2+e^2	Tone was a jarring discord. The pressure was more intense, slightly painful, and unsteady. It associated the scratching of a cat. (Due to sidewise movement of the point?)
30	b^1	Tone localized in a small round spot just above the stimulus. The pressure aroused a fine pain at the very point of application, but the pressure was less than in the preceding trial. (The point was applied to the left of the median region.)
40	d^2	Less painful than some of the above.
50	c^1(?)	Pain sharp. Pressure obscured. Tone uncertain.
50	e^2	Sharper pressure. Painful.

(*c.*) *Temperature.* We have mentioned that *R* thinks of the plunging of his hands into cold water as bright red. A very slight warmth matches a very low tone, but this match is mediated through the pale yellow color of the Appunn low forks. Aside from these two instances of colored temperature, all the associations with cold and warm sensations are those of tone. *R's* right hand, *e. g.*, became quite cold during one of the experiments. After feeling it with the left hand, he assigned to it the tone a^1. It is significant that cold hands are bright red and that a^1 is also bright red.[1] On another occasion the cold left hand felt g^1. Curiously enough, *R* asserted that he was utterly unable to pick this note upon the piano when striking the keys with his right hand, but got it easily enough with his left. The following are the experimental results.

(I.) *Warm.* The stimuli were given with the point or the butt end (1 cm. diameter) of a Goldscheider brass temperature cylinder, heated in most tests to 45° C.

(a.) *Warm Areas.* Preliminary tests with lesser warmth gave repeatedly upon areal stimulation of the back of the hand the note A_1. A much warmer rod, rather unpleasantly hot, gave the fusion f^1–a^1.

More extended tests with areal stimulation at exactly 45° C. gave upon the forehead B, a, e^1, f. Despite the constancy of the objective stimulus, the variations in sensitivity were very great, and the subjective intensity of the warmth varied directly as the pitch of the tone which was heard. In the next test, the stimulus was repeatedly applied upon a single place, giving in succession the tones a, B, c, d, b. The right cheek gave c^1; the plantar side of the wrist gave only a slight warmth and the correspondingly low tone g^1; the back of the hand gave scarcely any sensation of temperature and no tone.

(b.) *Warm Spots.* The exploration for warm spots was performed with the Scripture temperature cone. Two spots stimulated with a temperature under 45° C. gave c^1. With a temperature of 45°, every warm spot found gave f^1. Upon the cheek, three warm spots gave c^1.

(II.) *Cold.* The cold stimuli were given with a Goldscheider cylinder which had been cooled in melting ice.

(a.) *Cold Areas.* Areal cold stimulation upon the forehead was heard as f^3, $c^{\text{sharp }3}$, and $e^{\text{flat }3}$, upon the cheek as f^2 and $c^{\text{sharp }2}$; upon the back of the hand no tone resulted.

(b.) *Cold Spots.* Upon the forehead cold spots afforded the tones b^2, f^2, f^3, upon the cheek e^2 and g^2.

While these phonisms of temperature are necessarily irregular, in view of uncontrollable variations in the intensity of the sensations excited at different places and at different times by the same objective stimulus, it is not difficult to see that departure from the physiological zero in either direction produces a phonism which rises in pitch with the increasing intensity of the cold or warmth.

(5.) *Miscellaneous Synæsthetic Phenomena.* Again in contrast to *M*, *R* has no tendency to personify and no coloring of the alphabet; with the exception of two verbal associations

[1] See Table VIII.

("e" is yellow, the sound "ou" is blue). He has no coloring of voices, words, or dates, and no alphabet form. But he has a month form, in which the year rises from January to December in a steep curve.

Discussion of the Results.

The systematic investigation of these two cases of synæsthesia has brought out several facts which seem to us to be of importance.

1. A subject may declare himself to be possessed of colored hearing or similar secondary sensation systems, and yet be quite unconscious of the variety, depth, and uniformity of these associations until complete laboratory tests are instituted. For these reasons, the questionnaire, which has hitherto been practically the only method applied to these phenomena, is essentially inadequate and unsatisfactory.

2. Investigators must be prepared not only for a considerable degree of variation as between different individuals, but also for variation within the same individual.

3. The determination of the genesis of synæsthetic phenomena is difficult. Even serious laboratory investigation, supplemented by a more than ordinary introspective ability upon the part of the subjects, has not enabled us to discover the essential basis for many of the facts which have been cited. It can only be said that *R's* secondary sensations are directly, *M's* indirectly conjoined to their primary sensations. The mediating link for *M* is an affective process, probably based upon a mass of organic sensations.[1]

4. As a corollary from these propositions it follows that generalization is at present to be avoided.

As an illustration of this point we may note the lack of concordance of our results with some of the generalizations of Bleuler and Lehmann.[2]

a. "Bright photisms result from high pitches, intense pains, sharply defined touches." For *M* the highest Appunn forks gave no photisms. For *R* the highest notes are essentially characterized by the introduction of green into the series, while the highest note gave a Plate V. color.

b. "The same secondary sensation always corresponds to a given primary impression, but it may be modified by the prevailing ideas." This proposition is plainly negatived by the very vivid but very irregular photisms of Case I.

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[1] *Cf.* the opinions of Féré and Flournoy as summarized by Clavière, L'Année Psychologique V, p. 173.

[2] The passages designated by quotation marks are not intended to be literal quotations of Bleuler and Lehmann. See especially *op. cit.*, p. 96.

c. "Taste and smell photisms are located in the mouth and nose."[1] *M* projects clouds of light as with tones. *R's* colors are not localized.

d. "The order of frequency in colors is red, yellow, brown, blue; violet or green is seldom had." *M's* colors are predominately green if anything. *R's* list abounds with violet. Yellow is quite rare in both cases.

e. "Louder notes give more extended photisms." This has already been shown not to hold good in Case I.

f. "Pleasant delicate odors and tastes make pleasant, little saturated colors."[2] *R* had colors of the greatest possible saturation with tastes which were so weak as to be hardly recognizable.

5. The taste photisms of *R* seem to be worthy of special mention. Flournoy[3] mentions a few scattered instances of taste colors. Eberson[4] sees sour as blue, bitter as red or yellow. Bleuler and Lehmann[5] give bitter as dark brown or black; salt and sweet as bright colors; and add that mixed colors are never obtained. We have already noted that *R* gives uniformly sweet as blue, sour as green, bitter as orange-brown, and salt as dull red, and that mixed tastes induce mixed colors.

6. The phonisms to pain, pressure, and temperature possessed by the subject of Case II are, so far as we are aware, without parallel in the published accounts of synæsthesia.[6]

In view of the scattered nature of this literature, it is, however, quite possible that previous investigations upon this point may have escaped our notice.

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[1] *Op. cit.*, p. 42.
[2] *Op. cit.*, p. 40.
[3] *Op. cit.*, 109 ff.
[4] Ueber colorirten Geschmack, Wiener Presse, 1897, No. 49, p. 1542.
[5] *Op. cit.*, pp. 41–2.
[6] Attempted classifications of synæsthesia have, of course, recognized the possibility of these, as well as of many other correlations between the various modalities. Note, for example, the exhaustive schema of Suarez de Mendoza (L'Audition Colorée, Paris, 1890), to which Clavière refers. *Op. cit.*, V, p. 162.

THE SYNTHETIC EXPERIMENT.

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§ 1. ANALYSIS AND SYNTHESIS.

Nothing is more striking in the pages of current psychological literature than the extensive record of analytic work. Analysis is, certainly, one of the essential ingredients of the atmosphere of science; and it is not therefore surprising that, with the splendid examples of physics and biology before it, psychology should seriously attempt the reduction of its material to the lowest convenient terms. Although its errors in this regard have been eagerly pointed out from time to time, it is safe to say that the necessity for psychological dissection is not likely to be called in question. But the matter stands differently with the interpretation of analytical results; upon this point turn many disputes. One psychologist contends that analysis is an end in itself: that one goal of the science is to know how mind is made up; what the ultimate bits of mind are. Another, that analysis is an indispensable aid to the study of genesis. Another, that it sets forth the psychophysical couple, and by its help indirect causal explanation is made possible.

Instead of discussing these various views, the writer wishes to point out still another way in which analysis may be turned to account: namely, in breaking ground for a constructive treatment of consciousness.

If an analytic result shows the true elemental constituents, it should be possible, at least in a good many cases, by adding the elements one by one, to rebuild the original experience. Surely no better test of the accuracy of an analysis is possible than the reinstatement of the whole through synthesis of the products of dissection. It is, to put it in another way, theoretically possible to devise and carry out a synthetic experiment on the same plan as an analytic experiment is conducted. If we take advantage of special and constant conditions for the dissection of mind, why may we not as well make use of these conditions in building up mind again? To make the matter concrete: why should we not, if we find that liquidity is a perception made up of a number of known elements, bring these elements together artificially and produce the perception in

question? There is surely no new theoretical difficulty, at least. The present article proposes a very brief outline of experimental syntheses with one or two concrete instances worked through in detail.

It scarcely needs to be pointed out that the type of synthesis which is to be discussed is entirely different from the genetic type.[1] It is one thing to build up the identical consciousness that has just been dissected, and quite another to take the dissected bits of, say, the normal, adult consciousness and entrust them, as protopsychic units, to time for the creation of a mental phylogeny. Very grave objections may be made to the second procedure.

In general, our synthetic experiment will consist just in putting together artificially the elements into which we have previously dissolved a complex experience. The experiment will be a psychophysical one, as the analytic one usually is, because it will manipulate the conditions under which the experience arises. The tests of its validity will be two: (1) it will produce the experience without extraneous suggestion, and (2) it will produce the experience only when all the elements which it includes are present. When its validity is assured, it will furnish an absolute check upon analysis.

The artificial construction of consciousness is not, indeed, an esoteric process known to psychology alone. The alchemy of æsthetics has used it for centuries. The pictorial vehicle for conveying beauty is a fabrication of psychological elements. A crayon or a pigment gives the adequate stimulus to a color or brightness sensation, and the premeditated arrangement of these is the visual colligation which the artist *uses* to express his conception. The more fully the actual elements present suffice to elicit the psychological complex, the more truly is the operation a synthetic one. For there are very different degrees of synthesis. A bit of shadow in the woods may touch off the perception of a mounted warrior, or of a deep cleft in the soil, but only by way of suggestion. The actual presentation calls forth a very meager conscious reaction if the proper trend to consciousness be lacking. It is, one may say, only the train which explodes the mass of material already gathered and arranged. In the truly synthetic experiment, on the other hand, the materials are carefully sorted, brought together and fed to the psychophysical machine. Thus in the production

[1] The latter type is represented by Dr. Stout, who first makes an analysis of mind (*Analytic Psychology*) and on the basis of this analysis (see preface) constructs his scheme of development (*Manual of Psychology*), starting with the sensation or the 'sensation-reflex,' "the most primitive form of mental life which is distinctly recognizable" (Manual, p. 126).

of a painting, the æsthetic pronouncement which is called forth cannot be said to be synthetized, but only the color-brightness colligation from the pigments and the canvas.

§ 2. The Province of Synthetic Experimentation.

It follows from what has been said that the range of synthetic experimentation is much narrower than that of analytic. The former avoids suggestion and works only where all the factors can be easily controlled. The experimenter here copies nature. He sits, for the time being, before the "whirring loom of time" and plies the weaver's craft. Either he presents a bit of made-to-order environment to the organism which he considers for the moment as merely a psychophysical receptacle, or he manipulates the factors in a conscious movement or an emotion, contemplating the mind as a theater for staging a characteristic action or a dramatic situation.

It is not always easy to decide when one is reconstructing synthetically. As has just been pointed out, a mere cue to the organism, which sets up an elaborate reaction, is not to be regarded as a synthetizing stimulus. Suggestion must play no more or less important part than it does in the face of the usual 'normal' situation in experience. Where nature has compounded a situation, experiment simply stands in her stead.

The second difficulty arises from the similarity between our experiment and certain forms of illusion. This applies within the field of perception. The term "illusion" is used broadly and loosely in psychology. It may include, for example, every kind of trick to which the normal consciousness is liable. Tricks from the nervous mechanism (*e.g.*, phenomena of double conduction); tricks from peculiarities of the sense-organs (*e. g.*, the binocular vertical); tricks from association (*e. g.*, the size of the moon); tricks from judgment, memory, imagination, apperception. Since we have no definitive account of illusions from a systematic standpoint, it is useless to attempt a clear description of them. One has only to recall the multitude of theories: "intellectual," "perspective," "contrast," "confluxion," "mechanico-æsthetic," "physiological," and the host of interpretations, to convince oneself not only of the lack of finality in arrangement and explanation, but also of the heterogeneous nature of the matter crowded under the general heading.

The subject of illusions spreads itself over well nigh the entire field of psychology. Even within the geometrical illusions of sight—the type most thoroughly worked over—we have, without doubt, a number of distinct cases, arising from a variety of conditions. There will be no cause then for confusing the *general* field of illusions and the quite definite class of syntheses.

If it be insisted that both illusion and synthesis imply trick-

ing, it may be answered that from the psychological point of view a trick is the essence of neither. An illusion, as experienced, shows no trace of deception. It is simply a straight-forward experience which has, for psychology, no price set upon it. Only when it is given a value in a general system of experiences is it found to stand at a discount. One may say in the same way that the synthetic perception contains in itself nothing like deceit. It is made up of a collocation of *bona fide* elements. It is only when one views the perception externally, looking into the elements one by one, that one sees traces of the artificer.

Doubtless, instances will arise which we shall be inclined to classify both under illusions, as they are now conceived, and under syntheses, in the sense of the text; but this furnishes no reason for identifying the two classes.

To avoid confusion, the following points of difference between the illusion and the perceptual synthesis may be noted.

(1.) An illusion reveals a discrepancy when brought into juxtaposition with similar experiences; a synthesis does not.

(2.) An illusion may depend upon other factors than environmental (eye muscle strains, fixation), or may even arise without any peripheral stimulation (as an illusion of memory); a perceptual synthesis depends upon environmental circumstances only.

(3.) An illusion may be entirely compounded by nature (as the illusion of the size of the moon); a synthesis depends upon experimental artifice.

(4.) An illusion may arise in one part of an experience-complex through the operation of an adjacent part (*e. g.*, many optical illusions, as the parallel lines in the Hering and Zöllner patterns, the Müller-Lyer lines, interrupted extent, the inscribed square): in the perceptual synthesis, the perception is a unit; all elements retreat into the background and unite in producing the perception.

In general, illusion implies perceptual torsion. The cause for the torsion may lie either within or without the organism.

The individual builds his world under the guidance of convenient norms and units. This guidance is absolutely necessary, since experience varies from time to time and from circumstance to circumstance. When, now, a given experience is found to vary from its appropriate norm, the individual is said to fall into an illusion. The norm is violated or the unit changed in value. The synthesis, however, is compounded from nature's 'standard' prescriptions, but not at her hands. The general formula reads, for the cases which we have cited: $\alpha + \beta + \gamma = P$, where the small letters stand for the ingredients, and P for the resulting perception. If we write for the ordinary perception, $a + b + c = P$ we shall have for the illusion $(a^1 + b^1) + c = P^1$,

where $(a^1 + b^1)$ represents a partial change in the situation which 'distorts' P. The expression $\pm (P^1 - P)$ would stand, then, for the quantitative measure of the illusion. If now the torsion be given artificially the last equation will read $(a^1 + \beta^1) + c = P^1$. The parenthesis indicates that a *group* of elements is usually manipulated in the illusion, whereas each element stands for itself in the making of the perfect synthesis.

We have, finally, to distinguish experimental synthesis from a group of experiences in which quite a simple stimulus produces not its normal (usual) effect, but a new one. Take, as an instance, the apparent movement of a bright point fixated in an absolutely dark field. Movement is perceived, although the adequate stimulus to movement is probably lacking; there is, however, no deliberate synthetizing of the perception. If, on the other hand, a rapid succession of exposures, slightly different (as in the zootrope), be made, under suitable conditions, the movement perception is easily compounded.

§ 3. Types of Experimental Synthesis.

All the instances that have been cited, thus far, are instances of perceptual synthesis. They are syntheses of the first order; they stand on the lowest level of concrete experience and their constituents are the simplest possible. A good many instances of this type might be given. In vision, we have a typical instance in the stereoscopic representation of depth. Analysis has given the 'dimensions' of binocular space perceptions; stereoscopy has put some of these together synthetically. The pseudoscope, too, furnishes the conditions for a similar synthesis; and, finally, the stroboscope completes the synthesis of a third great class of visual perceptions.

Professor A. Kirschmann has given a good example of the synthetic procedure in vision in the artificial construction of metallic lustre done in connection with his study of the parallax of indirect vision (*Philos. Stud.*, XI, 147 ff.). After recalling the possible visual factors—qualitative, intensive, spatial and temporal—into which the perception of lustre can be analyzed, he proceeds, by elimination, to select the real elements. These he synthetizes in an *experimentum crucis*, and succeeds in constructing artificially (by means of gelatine sheets, etc.), the perception in question. This instance is peculiarly instructive because it shows the value of the synthetic experiment in case direct experimental analysis must, of necessity, be replaced by indirect and logical processes.

Closely allied to Kirschmann's experiment, is Wundt's synthesis of the reflection of objects, in their proper colors, by a colored, highly polished object. The synthesis is made for both monocular and binocular vision by the use of reflected images.

(*Cf. H. and A. Psych.*, 199 ff., and *Grundzüge d. physiol. Psychol.*, 3rd ed., II, 177-8.)

In audition, the scope for synthetic work is not so broad as in vision; neither has the field been so well covered. Still, we have the synthesis of sound localization by the adjustment of binaural intensities and the synthesis of the note by the fusion of fundamental and overtones. There is still room for much construction in creating the clang-tint of instruments by intensity gradations among the partials, and the addition of appropriate noises.

Among tactual perceptions, involving cutaneous and subcutaneous sensations, there is still more to be done. These perceptions will be taken up somewhat fully later; hence a discussion of them here may be omitted.

Finally, our programme of perceptual syntheses demands a place for taste and smell complexes. These senses are very strongly affective and quite weakly perceptive when they stand by themselves. Odors, it is true, betray by their names a strong tendency to arouse ideas—they are active incentives to association—but for this very reason they do not serve well in the class of experiments which we are considering. They are too suggestive. We get, however, some fairly good synthetic material by the addition of tactual factors to taste and smell. The perception of many drinks—as cider, lemonade and wines—is probably quite capable of synthetic imitation through these three factors.

Are there, we have to ask now, synthetic experiments outside perception? Is artificial construction feasible in any other way than by bringing to the organism elements which, when taken in together, mean an object-in-the-world? Let us look at some other forms of consciousness for an answer to this question.

We turn naturally from perceptions to feelings, because feelings stand on the same general level as the simpler perceptions. But when we attempt to synthetize feelings various difficulties confront us. (1) Pleasantness and unpleasantness, the most prominent elements in the feeling, denote a more general reaction than sensation and are, therefore, less amenable to control. (2) The sensations most prominent in the simple feelings are organic; hence they are less accessible to experimentation. (3) But the most formidable difficulty is this: a simple stimulus conditions at once the sensation and the affection. Piecemeal construction of the complex is, for this reason, impossible.

When, however, we ascend to the level of the emotion, we find that these difficulties are less serious than in the case of feelings. Indeed, if we were to work upon the basis of a 'Reverberation' theory, the reconstruction of all the typical emotions would be conceivable. Instead of a situation acting

indirectly upon muscle, gland, blood vessel, and viscus, the function of these would be altered more directly and in such a way as to kindle the emotion. It would, doubtless, be asking too much of such a theory to expect a reproduction of all the emotions under experimental conditions; but certain of them ought surely to lie under control.

Professor James remarks (*Psychology*, II, 450) that "the immense number of parts modified in each emotion is what makes it so difficult for us to reproduce in cold blood the total and integral expression of any one of them. . . . Just as an artificially imitated sneeze lacks something of the reality, so the attempt to imitate an emotion in the absence of its normal instigating cause is apt to be rather 'hollow.'" Still, he shows later that not only are 'objectless' emotive states common in mental pathology, but that voluntary arousal of emotions is quite possible within limits (462 ff.). Lehmann criticises Lange (*Hauptgesetze, etc.*, 114 ff.) for his identification of ordinary emotions and those simulated by the use of drugs. He himself contrasts the "normal" emotion (the emotion arising in face of a situation) and the artificial. The essential difference is, he thinks, that the first is consciously motived, while the second is not. Considered psychologically, then, the normal and the artificial emotion cannot be identical, though both may lead to the same changes in motor innervation.

So far as the matter of emotive architecture turns upon a point in theory it may, of course, be neglected, since the present outline aims only at indicating a general scheme. Evidently, the success of the synthetic procedure depends, in the present case, upon the true nature of emotion and the essential conditions which underlie it: matters which we cannot discuss here. Even though we adopt Lehmann's conservatism, we may still include simulations under emotions, and thus make a way for our method.

One must by all means guard carefully the purity of the emotive synthesis: one must ask whether all the necessary conditions have been actually arranged for, or whether association (as association of facial contractions, swallowings and forced tears with sorrow) takes the event well toward the limits of the experimental type. These are questions for experiment and introspection, not for theory, to settle. We cannot say that, at present, there is any satisfactory method known to experiment for synthetizing an emotional state by way of its immediate physiological conditions. Nevertheless, the success of crude attempts at producing fear, sorrow, and joy makes the case hopeful.

But more important still is the fact that the reconstruction of an emotional situation is among the resources of the laboratory.

Of course the synthesis does not issue from the simplest elements as in the perception; but that is scarcely to be expected in so complex a consciousness. It must also be said that the emotional situation is so often a matter of human relationships that no hard and fast line can be drawn between natural and artificial instances.

We have still to discuss the class of experimental syntheses which have been, thus far, most serviceable to psychology: the class of artificially synthetized *actions*. Action, particularly in its simplest forms, is so fleet-footed that introspection has well-nigh despaired of overtaking it. It is by all means desirable that it be brought within bounds. This is accomplished by the Reaction experiment. Whatever else the Reaction experiment accomplishes, it gives the coveted opportunity for building up, piece by piece, conscious action as simple or as complex as the psychologist desires. If action included only movement and its results in consciousness we should be dealing simply with another case of perceptual synthesis: the perception of movement. But action is more; it starts with the apprehension of a stimulus, runs through various intervening processes, which vary with the type of action, and issues in movement.

The limits of the action-synthesis are these: (1) it brings the action-stimulus to the organism instead of allowing it to evolve centrally (as the result of ratiocination, *e. g.*); (2) it presupposes rather than creates an action attitude: that is to say, it gives a stimulus which would not necessarily lead to action under natural conditions; only when the connection of action with the artificial stimulus is arranged beforehand is the action completed. Finally (3) the purity of the synthesis is somewhat impaired by the central concomitants (memory, expectation images, choice, etc.) of action.

These limitations are, however, not so serious as they seem to be at first sight, for (1) the objective situation is the usual and, without doubt, the original incentive to action; again, (2) with numerous repetitions, the artificial stimulus assumes more and more the characteristics of the normal excitant to movement; and, lastly, (3) although the synthesis is not pure, the situation is actually reconstructed and the central accessory processes are controlled by variation of conditions.

We found in synthesis of the first type that the more one interpolates associative processes the farther one gets from pure synthesis. Now such processes do come in prominently in various forms of compound reaction, as well as processes corresponding to the logical terms judgment, inference, reasoning; but there is a difference. There the processes were interpolated quite loosely and took us beyond the immediate perception. Here they are not only integral parts of the synthetized action, but

they are directly controlled by the terms of the experiment. The importance of this type of synthesis does not need to be urged. The fact that psychology is able by its means to construct any grade of action from psychomotor to highly involved ratiocinative action, and thus to study the whole range of the action consciousness, shows its great usefulness to the science.

We must not in thus extending the limits of synthetic experimentation overrate its results. Even though we are successful in building up, for example, a perception out of the products of analysis, we cannot say, straightway, that a complete description is given of the structure of the perception in the enumeration of the elements. Putting the case in psychophysical terms, we are not warranted in saying that because a stimulus complex $\alpha + \beta + \gamma$ supplies the necessary conditions for the appearance of a given perception, the perception *is* only the sum of the elements which the stimulus represents. This may be true, and it may not: the synthetic experiment does not determine. Whether there are such things as "Tongestalten" or "Raumgestalten," "Gestaltqualitäten," "Complexionen," and "fundirte Inhälte," the synthetic experiment cannot decide. The discussion of these things turns upon the question as to *how* consciousnesses are put together: whether by a summating, or a consolidating, or some other process.

We seem at first thought to secure in the synthetic procedure all that was lacking in justification of analysis: namely, the assurance that it has dissolved the matrix of mind-stuff and got hold of all there is of it; but we find that we have only added the fact that the elements do work when put together thus and thus; not what is in the product, or sum, or creation, whichever it may turn out to be.

The justification of analysis that we have found is, then, a justification of particular cases. The validity of analysis, in general, we have not touched. As we said at the outset, we verify an analysis if, by reversing the analytical process, we come back to our starting point. The question whether or not mind, considered organically, but quite anatomically, is more or less than, or equal to, the sum of the abstract elements which our analysis reveals must be answered from a different plane from that of the present discussion. We hope to consider this question in another connection.

Leaving, now, the general aspects of the subject of synthesis, we come to the treatment of a particular set of problems which our method encounters; and finally, to the record of a single experiment in synthesis.

The class of perceptions that we have chosen are those arising through stimulation of the tactual organs, and the particular synthesis the artificial construction of liquidity.

§ 4. Synthesis of Cutaneous Perceptions.

The skin is burdened with offices. One of the surprises of physiology is the revelation of the multitude of functions performed by this apparently simple organ. As a rind it is not only the container, but the warder-off, and also the go-between for the organism and its world; tegument, buckler, interagent. It is small wonder that its work is represented in mental process; that many of our most worn and useful perceptions are made up of cutaneous sensations.

The antiquity of tactual perceptions—sharpness, bluntness, smoothness, roughness, wetness, softness, hardness, resistance, tickling, itching, traction, movement, and projection from the body-surface—must be very great. Most of them have had a high survival value in the race's history. The skin as the primitive sense-organ had for a long time to fight its own battles. It has come out not only unscathed but with its susceptibility greatly reinforced by the conflict. It breathes mind at every pore. Its tissue lies packed with sensation, waiting for its Helmholtz to spell it out.

Something has indeed been done in recent years to unravel the tangled skein of perceptions whose origin lies at the borders of the organism. Analysis has cunningly searched out the elements of the complexes and has pointed to the specific organs which condition them. Much systematic work remains. And a good deal of this will consist in putting together what has already been abstracted from the total mass. A bit of this construction we have attempted in the remainder of the study.

Liquidity.

A good deal remains to be done here by way of preliminary dissection. The apprehension of wetness is commonly considered something unique: the finger touches a wet surface, or the hand is plunged into a liquid, or the body is immersed, and one is said just "to feel wet." This is a striking instance of the confusion of mental processes and their significance; in this case, a confusion of sensation with perception. It is, moreover, hardly likely that liquidity is perceived through even an unique kind of sensation. Working then under the rule of the Law of Parsimony an attempt has been made in what follows to reduce liquidity to known sensational elements—we have pressure, pain, thermal,[1] tendinous, muscular and articular sensations to draw upon—and afterward to synthetize it *de novo*.

i. A series of liquids of varying specific gravities, degrees

[1] A striking case of thermal synthesis, worked out by S. Alrutz (*Mind*, 1898), p. 141, is the production of the 'hot' fusion by means of the simultaneous stimulation of warm and cold organs.

of viscosity and volatility was collected. This included mercury, petroleum, eldorado oil, water, molasses, benzine and ether.

In giving the stimuli, the first and prime precaution was to rule out other senses than the cutaneous and subcutaneous. The eyes were bandaged or kept closed, the nose (and when necessary the ears) stopped with cotton, and the member used kept quiet, or moved only under definite control. The middle finger of the right hand was used in most cases. Control experiments were made with all the fingers, with the palm, and with the whole hand and wrist.

With these limitations the perception of liquidity was marvellously narrowed down and simplified. The eyes and the nose are extremely useful (as in many other perceptions) in helping out the skin.

Instead of moving the finger into and out of the various liquids, it was found best to place the arm comfortably on a rest with the finger projecting over the edge, and then to raise and lower the containing vessel (a beaker of convenient size).

To avoid quivering of the liquid, the beaker was set in an elevator which was operated by a cord run over a pulley at the ceiling and wound upon a small drum. The drum was revolved very slowly and steadily by means of a long crank.

Suggestion was avoided just as far as possible. The subject was brought, eyes blindfolded and nostrils stopped, from an adjoining room before each experiment. The experiment consisted of three parts: (1) contact of the finger with the liquid surface ("ad"); (2) immersion of the finger about as far as the first joint ("in"); and (3) withdrawal from the liquid ("ex"). The test began as soon as the subject was comfortably seated; a warning signal (for the attention) was given before each of the three parts. The subject gave a running introspective account during the experiment and completed it immediately afterward. The operator kept the record-book. From four to nine records were taken in an hour.

Dr. W. B. Lane (L.) and the writer's wife (S.) kindly served as subjects. The writer acted as operator and occasionally as subject. The work was carried on in this laboratory during the winter term of the present year.

Results.

Before the investigation had proceeded far, it became evident that the cutaneous processes, when isolated, function rather clumsily: differences in density, viscosity, etc., passed unnoticed when color, transparency, odor, sound and lateral or irregular movements were wanting. For example, molasses, benzine and even mercury passed under certain thermal conditions for

water: an indication of how widely the organism is obliged to draw upon its resources for the completion of so simple a perception as that of a liquid.

The Tables which follow show the results for mercury, benzine and water: a heavy 'dry,'—a light volatile,—and a moderately heavy liquid. Results from the other liquids used need not be tabulated. The oils—petroleum and eldorado—stand between water and mercury in specific gravity: their oiliness disappeared under the conditions of the experiments. Only when there was a jar of the vessel, or a sudden movement of the finger, or a rubbing of two surfaces, was the 'oily' perception obtained. S did not once perceive 'oiliness' throughout the experiments. This perception remains to be worked out under Smoothness and Resistance. When the oils were distinguished from water and mercury, pressure intensity seemed to be the only criterion if the skin alone was concerned.

Ether and benzine gave similar results; the difference being the more intense cold after the removal of the ether.

Let us examine the tables. The stimulus is named on the left, then follow columns for the stage and number of the experiment, the subject, and his report. C = cold; W = warm; P = pressure, etc.; o = present; oo = present at a very high intensity; — = present at decreased intensity. Where no objective temperature is noted the substance has the temperature of the room. Temperatures were not kept in degrees because (1) the zero point of the skin shifts very greatly, and because (2) quantitative results were not in the least cared for, except where they could throw light on qualitative questions.

The results are pretty uniform. Pressure and temperature are evidently the two important factors in liquidity. The record shows that the pressure is of a peculiar kind. It is a close-fitting pressure, strongest at the tip and at the ring (when a ring is present). It has a tendency (naturally) to grow faint as it continues. Often when the member is immersed the subject is doubtful whether any pressure remains. Another peculiarity of the liquidity-pressure is its advance and recession: it creeps up and down. At first the subjects declared that the wetness was something added to the pressure and temperature: it was, for them, unique. Later L found in it a peculiar mixture of warm and cold, especially when a warm stimulus was given. There seemed in the wet to be little spots of cold sprinkled around in the warm.

To test the uniqueness of the 'wet' an experiment was arranged in which pressure and temperature were eliminated, while the stimulus was actually moist. The required conditions were obtained both with water and benzine. L, whose pressure limen for the finger is rather high, got no sensation (water

TABLE I.

Mercury.	Subj.	No.	C.	W.	P.	Remarks.	Ring.	Traction.	Perc'n.	Remarks.
Ad.	L.	1	oo							
	L.	2	o		o					
	S.	3	o		o					
(Lukewarm)	S.	4		o	o					
"	S.	5				Tip in warm air.				
	S.	6	o		o					
	S.	7	o		oo					
	B.	8	o		o					
	B.	9	o		o					
In.	L.	1	—							
	L.	2	o		o	Strongest at tip.	o			
	S.	3	—		o	On ball of finger.	o			
	S.	4		o	o	At tip.	o			
	S.	5					o			
	S.	6					o			
	S.	7	o		oo		o			
	B.	8	o		o		o			
	B.	9	o		o		o			
Ex.	L.	1			o	Clinging pull, then push.				
	L.	2			o			o		Like water, but P. too great.
	S.	3			o	Dwindled to point.			Hg.	
	S.	4			o	Left at tip.	o			
	S.	5			o	Left at tip.				Warm air till finger moved, then water.
	S.	6			o	Dwindled to point.			H_2O	
	S.	7			o	Dwindled to point.			H_2O	
	B.	8	o		o	C. and P. disappearing.	o			Did not know when liq. left.
	B.	9	o		o	" "	o			

TABLE II.

Benzine.	Subj.	No.	C.	W.	P.	Remarks.	Ring.	Traction.	Perc'n.	Remarks.
Ad.	L.	1	0		0	P. less than water.				
	L.	2	0	0	0					
(Lukewarm)	L.	3								
	L.	4	0		0					
(Lukewarm)	L.	5		?						
	S.	6	0		0					
	S.	7	0		0					
(Lukewarm)	S.	8		0	0					
"	S.	9		0	0	Dry vapor.				
"	S.	10		0		No wetness.				
"	S.	11	0			"				
"	B.	12		0	0	"	0			
"	B.	13		0		Difficult to place W.				
In.	L.	1	0		0					
	L.	2								
	L.	3	0		?					
	L.	4	0		0					
	L.	5	0	0	?		0			
	S.	6	0	0			0			
	S.	7	0		0		0			
	S.	8		0	0		0			
	S.	9			0	No wetness.				
	S.	10		0		"				
	S.	11	0		0	Feathery (dry) P. in patches				
	B.	12		0	0					
	B.	13	0			Cold in patches. Dry.				
Ex.	L.	1						0		
	L.	2	0					0		Confused *ad*, *in* and *ex.*
	L.	3	00							" " "
	L.	4	0							" " "
	L.	5	0							" " (Wetness after *ex.*)
	S.	6	0							" "
	S.	7			0				Benzine.	
	S.	8	0							No wetness.
	S.	9	0							Suppose it has been wet.
	S.	10	0							No wetness.
	S.	11	00							No wetness.
	B.	12		—	0	Turgidity of finger-end.			Light Liquid.	Advancing wet.
	B.	13	0		0					

TABLE III.

Water.	Subj.	No.	C.	W.	P.	Remarks.	Ring.	Traction.	Perc'n.	Remarks.
Ad.	L.	1	o		o					Wet.
(Lukewarm.)	L.	2								
"	L.	3			o					
"	L.	4								
"	L.	5		o		No wetness.				
"	L.	6			o	"				
(Cold.)	L.	7	o		o					Wet.
	S.	8	o		o				Hg?	Wet.
(Lukewarm.)	S.	9		o	o					
"	S.	10		o						Leaving water, *ad* and *ex* confused.
"	S.	11								
"	S.	12		o	o					
(Cold.)	B.	13	o		o					
In.	L.	1	o		o					
	L.	2		o	?					Wet.
	L.	3	o	o	?					Wet.
(Cold added.)	L.	4	o	o	o				H_2O & Benzine	Wet. Wetter [when cold added.]
	L.	5		o	o	W. delayed.				Wet.
	L.	6	o	o	o					Wet.
	L.	7	o	o	o					Wet.
	S.	8	o		o					
	S.	9					o		H_2O	Wet.
	S.	10								
	S.	11		o	o					Wet. Immersed in liquid.
(Cold added.)	S.	12				Later got P. and C.	o		H_2O	Wet when P. and C. came.
	B.	13			o		o			
Ex.	L.	1	o		o	Receding.			H_2O	Wet.
	L.	2	o		o				Benzine.	Wet. Confused *ad* and *ex*.
	L.	3	o		o					Wetter when out, *i. e.*, cold.
	L.	4								
	L.	5	o	o						Wet at tip.
	L.	6	o	o		Wet going up.				Took *ex* for *ad*.
	L.	7	o	+o						Less wet than at *in*.
	S.	8			o	Receded to tip.				
	S.	9			o	Receding.				
	S.	10	o		o	Entering cool H_2O.				When temp. =o *ad* o *ex* gave no sens. or slight P.
	S.	11	o		o	Slight P. at tip.				
	S.	12								Confused *ad* and *ex*.
	B.	13			—o	Left, cold and wet. P. evaporated.			Liq. betw'n H_2O & Hg	

experiments 2 and 4, *ad*: benzine experiments 3 and 5, *ad*) when the lukewarm liquid was brought over the end of the finger slowly and carefully. Later, when the finger was well immersed, slight pressure and thermal sensations came, and gave wetness. This wetness was increased (water experiment 4, *in*) when cold was added. With S the pressure was not so easily eliminated. Still, where pressure stands without temperature (benzine experiment 9, *in*) no perception of wetness is formed. Similarly, where temperature (either cold or warm) stands without pressure (benzine experiments 10 and 11, *ad*, and 10, *in*) no wetness is given. Even when a feathery, patchy pressure is felt wetness is still absent (benzine experiment 11, *in*). B, also, perceived no wetness from warm or cold by itself (benzine experiment 13, *ad* and *in*).

From these facts we conclude that it is not the actual moisture, as such, upon the skin that gives the perception of wetness.[1] In several cases this has been present, but where either temperature or pressure was lacking 'wetness' was also lacking. An exception is made below for the heavier liquids. Further testimony concerning the elements in the perception will be given in the synthetic experiments.

We have still to note in this connection the differences in the successive stages of the experiment. The only factors which distinguish the perception of being-in-a-liquid from the perception of entering-a-liquid are (1) various changes in intensity and extent of pressure and temperature, and, occasionally, (2) the addition of a ring. The ring itself is easily shown to be only a more intense pressure than the rest, with, sometimes, temperature added. It is usually well-defined in the heavy liquids and vague or lacking in the light.

The upward movement was stopped at *ad*, and, after the report was given, continued. The continued movement was perceived by the subject as an advance of the liquid.

Since the sensitivity for pressure varies at different parts of the finger, the pressure was not equally intense at all places. It was most apparent on the tip and ball of the finger and at the edges of the nail. Still, there were no sharp limits to make the pressure seem patchy.

With the lighter liquids it is seen that the advancing, well-distributed pressure was not sufficiently clear to give the appropriate perception *when temperature was absent.* Mercury, on the other hand, gave a well defined 'snug' advancing pressure and was therefore perceived as liquid even without temperature. But it is a significant fact that mercury, when

[1] We avoided soaking the member; the shrivelling of the cuticle from long exposure to moisture undoubtedly furnishes an indirect means of determining the presence of a liquid.

cold, left a "wetness" after *ex.* Here, again, is a perception of wetness with no objective moisture.[1] The withdrawal of the stimulus was sometimes perceived as a recession toward the tip; sometimes as a mere 'evaporating' decrease in pressure with no change in extent; this with the lighter liquids or with a decreased sensitivity through the continued presence of a strong pressure stimulus. Finally, a bit of traction was sometimes noticed as the stimulus left the finger. This was most apparent with mercury. Whether traction is a unique sensation, incapable of analysis, we shall have to consider later. We find that with the lighter liquids at least—ether, benzine, water—it was not available for the discrimination of entrance and withdrawal. Concerning its peculiar nature we wish to remark by way of anticipation that we found by careful testing that a slight (though supraliminal) traction is easily mistaken for pressure and *vice versa*.

ii. We are ready now for reconstruction. We have found that the apprehension of liquidity when it is confined to the sphere of cutaneous perception consists, in its simplest form, of three parts: (1) entering, (2) being in, (3) withdrawing; that in this form, (a) the 'dimensions' of liquidity are pressure and temperature, and (b) the three parts are distinguished by peculiar combinations of these factors.

If, now, our analysis is correct, we are in a position to verify it by reproducing artificially the perception in the three stages just enumerated.

The first attempt at synthesis was made by stretching lightly a sheet of thin rubber tissue over the top of a beaker and raising the beaker in its elevator till it came in contact (*ad*) with the finger tip (right middle finger, as before). By raising the beaker higher, the finger sank into the rubber (*in*); and by lowering, the rubber was withdrawn (*ex*).

The following notes are taken from the record-book for the first trials.

Subject: L.

I *Ad.:* Slight warmth and pressure.
In: Pressure advances half way up nail; clinging, silky, *i. e.*, pressure at minute points.
Ex: Uneven pressure.

II *Ad:* Pressure too firm for a liquid.
In: Same. No advance on finger.
Ex: Pressure left. No traction as from a film.

Subject: S.

I *Ad:* Pressure.
In: Pressure extending irregularly; various intensities.

[1] Another bit of evidence is given by the well-known fact that mercury 'feels wet,' although it is actually dry.

Ex: Pressure left all at once except small place at tip. Semi-solid; perhaps gelatine.
II *Ad:* Pressure.
In: Pressure advancing: film. Pressure uneven.
Ex: Pressure receding: pulled off. Rubber.

The results, though quite negative, are instructive. The temperature and the intensity and distribution of pressure evidently are not right for wetness. To adjust the pressure-element, powdered soapstone was sprinkled on the rubber. Now L perceived wetness at *ad*, but lost it as the pressure increased. S, who noted that pressure was evenly distributed and came around the finger, perceived a gelatinous substance as before. To relieve the pressure, the point of a burette was introduced to the beaker under the rubber sheet which was blown gently up and down. At *ex* the pressure was made to dwindle to a point by means of air-puffs, and L then reported a perception of mercury or other heavy liquid leaving the finger. When mercury actually replaced the soapstone on the rubber his perception was the same. Again, the rubber tissue was tried with a breath of cold air driven across its surface. This L declared to be a wet cloth, touching only near the tip. S, with greater sensitivity, noticed that the cold covered a larger surface than the pressure, and shifted. She thus detected the air blast and failed to perceive wetness.

Various powdery substances,—wheat flour and lycopodium powder,—were tried. The finger was introduced by precisely the same method as before. With L, flour gave at *ad* cold and pressure, and was judged to be a liquid (mercury?); this perception was killed at *in* by slipping and sticking, *i. e.*, irregular pressure; *ex* was observed to be unlike a liquid; there was no smooth, faint dwindling to a point. With B there was no temperature, and liquidity went no farther than "an unbroken film of heavy liquid" at *ad*. At *in* too great pressure at the tip killed the liquidity. S got decided wetness at *in*, with both cold flour and cold lycopodium; at *ad* wetness was doubtful, and at *ex* killed by the clumsy slipping-off of the substance.

To control pressure L was given flour in a cloth funnel supported by the operator's hand. To simulate the liquid boundary a small brass ring (cold) was on the flour, and the finger was inserted. By carefully changing the shape of the funnel the pressure was regulated.

The introspective account follows:

Subject L.
Flour. *Ad:* Cold and pressure.
In: Greater pressure: more intense inside finger: then more evenly distributed. Ring at surface (pressure or traction?). A liquid.
Ex: Left at point like liquid, but drew off instead of rolling. Traction. Perception: a liquid plus a solid.

A repetition gave the same result, except that there was a jar at *ex*. The liquid at this point was said to be like mercury.

Here the synthesis was entirely successful except at the *ex*. Even here liquidity was not lost; only solidity added.

The effect of the advancing ring by itself was tried on S. A rubber band two millimeters wide was stretched slightly in the thumb and finger of either hand and passed slowly and carefully up the subject's finger. The record follows:

Subject S.

Rubber ring.
Ad: Delicate pressure at tip, and warmth.
In: Distinct ring advancing, and pressure below [doubtless after-image of pressure]; warmth. *A thick liquid.*
Ex: Descending pressure, stuck at one place. This unlike a liquid.

A beakerful of light cotton, slightly depressed in the center, was also used as a synthetic stimulus. With L, the stimulus gave the perception of mercury; this entirely from the distribution of pressure, evidently, since no temperature was sensed. A mercury stimulus had been used a few minutes previously, and the introspective analysis of the two experiences differed only in two minor particulars: (1) mercury gave a ring, and (2) its traction at *ex* was slightly greater than the cotton produced. S got cold and pressure from the cotton, but noticed a slight irregularity in the advance of the stimulus: however, wet was perceived at the tip and remained even after *ex*. (Analysis gave cold and pressure.)

To test this stimulus further the whole hand was immersed in a jar of cotton. L reported pressure and warmth: pressure increasing from "a cobweb-like feel" as the hand was thrust deeper into the substance. No perception was completed until *ex*, when "a heavy liquid like mercury" was reported. The member felt wet when entirely removed from the jar. A repetition gave the same result. S got cold and pressure: at *in* the perception was "clinging, sticky," and later, "perhaps, liquid."

Besides the liquidity perception which comes from immersion, there is the perception of a liquid as dropped-on. The synthesis of the latter was attempted as follows.

Subject L. I. Synthetic stimulus: filled circle of metal on palm.
Report: Strong pressure and cold. Wet? Wet after stimulus left.
II. Air blown on palm from glass tube.
Report: Pressure and cold spreading indefinitely from a point. Wet. Repeated four times with similar result. Twice pressure was not found; four times warm was found with cold. *Always wet:* "a volatile liquid, like ether."

S sometimes perceived a drop of mercury from the air blast, and sometimes perceived the air current (the pressure extending too indefinitely to be a liquid). A stream of cold lycopo-

dium powder was perceived as a liquid, which, however, soon disappeared.

Since the chief difficulty in synthetizing liquidity has been the production of an even, close-fitting pressure, it occurred to the experimenter to arrange a set of conditions which should offer all the advantages of liquid pressure, but which should exclude actual moisture. We saw some pages back that it was possible for a moist substance to be in contact with the skin without giving rise to the perception of liquidity. Now it is proposed to bar out moisture from the liquid stimulus and see whether a perception of liquidity will arise. To this end two methods have been employed. The first is as follows. A rather deep glass jar, eight centimeters wide at the mouth, was filled with water. A weight, two centimeters in diameter, was laid in the center of a large sheet of rubber tissue which was lowered into the liquid, its edges hanging over the sides of the jar. This formed a dry, blind pocket surrounded by water. The pocket was kept closed by the gentle pressure of the liquid. The middle finger of the right hand was inserted carefully, the water causing the rubber tissue to lie close to the skin as the finger descended. Cold (zero centigrade), warm and lukewarm temperatures were used. The results agree for the various observers—L, S, B, and several others. The cold stimulus gave a decided perception of wetness. This was occasionally marred by a slight pull or an unevenness of the tissue. The *ex* was the only part of the perception which was not well simulated. Occasionally it lacked the gradually receding pressure which a liquid gives. Many times, however, the whole course of the synthesis was complete, and did not disappear when the eyes were opened and the actual conditions observed. Warm water gave a less decided wetness, and lukewarm a very faint liquidity or none at all. The substances perceived were water, mercury and liquids of intermediate weight.

The second method was simpler. A thin rubber sheath was drawn over the finger, and the finger lowered into the liquid. The perception of liquidity here was complete, the subjects at first refusing to believe that the finger was not actually wetted. The perception lasted (with cold water) for some time after withdrawal.

Let us see what the net result of our work is. The *analysis* of the liquidity perception is too straightforward to need comment. We found simply that under certain definite conditions the perception could be factored with comparative ease. We then started our synthesis with all our terms known, and with the additional suggestion that moist substances do not neces-

sarily "feel wet." The first step was the bringing together of pressure and thermal conditions in the simplest, though the most artificial, way. The synthesis was, naturally, crude; but in the making we learned to handle our material, hence we were able gradually to eliminate disturbing factors and to make the synthesis cleaner and more clear-cut. We found by working with various materials that the actual substance used—whether a powder, a tissue, a rubber band, or a metal—made little difference so long as it brought together the essential elements in the necessary mode of combination. Having built up quite completely our perception, we turned to Nature for a hint as to refinement of method. We were not disappointed. Taking from her the ingredients which our previous essays had shown to be essential, but rejecting her superfluous ingredient—'moisture'—we got the neatest synthesis so far obtained; thus demonstrating that Nature, even when disabled, speaks to the organism in the most intelligible symbols. To be sure, the outcome of these 'water' experiments is so obvious that any one (with, perhaps, the exception of the experimenter!) might have prophesied it without hesitation. But it will be seen that the tests have a very great importance as they stand in the series.

It is not too much to say, then, that we have given a fair illustration of a somewhat novel, though important, use to which the results of analysis may be put: that we have shown that there is nothing unique in the elemental constituents of the perception with which we have been dealing, and, finally, that out of these constituents we have succeeded in building up, by way of experimental synthesis, the complete perception of liquidity.

PSYCHOLOGICAL LITERATURE.

Die moderne physiologische Psychologie in Deutschland, eine historisch-kritische Untersuchung mit besonderer Berücksichtigung des Problems der Aufmerksamkeit. W. HEINRICH. Zweite, teilweise umgearbeitete und vergrösserte Ausgabe. Zürich, Verlag von E. Speidel, 1899.

It is not easy to find a *raison d'être* for this work. As it is in the second edition it cannot wholly be attributed to what G. E. Müller calls a "*leichtfertige Productionssucht*," though the lack of constructive criticism, together with the remarkable number of critical errors, would seem to exclude any other theory. Assuredly, a critic who asserts that Külpe's "Grundriss" is scientifically of no importance (p. 151), whilst he refers the reader to Münsterberg's second "Beitrag" for a final solution of the time-sense problem (p. 64), would hardly be regarded by most psychologists as elected to fulfil the functions of the higher psychological criticism. The first 38 pages of the work are taken up with an historical introduction, running from the fall of Greek philosophy to Lotze; the necessity of such an introduction and its logical connection with the rest of the work are not obvious. In this historical introduction, however, the originator of Weber's Law is not considered.

In the preface Heinrich states that instead of applying his own opinions to the theories of others he proposes to use an objective standard of criticism in the shape of the doctrine of psychophysical parallelism. Beyond the general statement that the physical and psychical processes are to be considered separate, the reader is not informed what particular form of this doctrine Heinrich holds, until the close of the work, but is obliged to construct it from the several criticisms—a by no means easy task. But as weighed in this psychophysical balance, Fechner, Helmholtz, G. E. Müller, Pilzecker, Wundt and N. Lange, Külpe, Ziehen, Münsterberg, Ribot and Exner, are all found wanting. Avenarius alone stands the test.

The ground covered by Heinrich in his criticism of Fechner has, in the course of time, become pretty well trodden. There is one matter, however, in regard to which, perhaps, all psychologists are not clear, and which the counsel of Heinrich has made darker. In the early days of psychophysics von Kries objected to Fechner's theory of the direct measurability of a sensation by the liminal differences. His view was, as we now see, the correct one, that a sensation is not to be regarded as made up of a series of liminal difference units. Unfortunately he stated his objection in the form that one cannot say differences of sensation are like and therefore comparable. To this Fechner returned that differences of sensation could be compared, and that Plateau and Delbœuf had compared them. Heinrich's extraordinary criticism on Fechner's reply is to ask if the measurability of sensation is proven by experimental work (p. 51), and he lays it down hard and fast that differences of sensation are not comparable because they are not and cannot be 'given.' A logical deduction from this statement as well as from the assertion (p. 49) that different shades of red "appear quite as different as red and sweet," would be that the mental make-up of the author is fundamentally different from that of

all normal people. The correct view, as regards the first statement, probably is that Heinrich does not understand the import of the method of "mean gradations." He calls Fechner's view of the conservation of energy 'naïve': there is no doubt but that the view which Heinrich attributes to Fechner, viz., that the human body is "a system in which energy is directly transferable from the muscles to the brain" is naïve, but the naïveté is not Fechner's.

G. E. Müller's theory of attention Heinrich finds is out of date, and Pilzecker's elaboration of it is too schematic (p .79). The mistake which Heinrich makes in regard to Müller's views of psychophysical interaction (p. 69) arises from Müller's use of the terminology of Lotze.

It is on Wundt, however, that the phials of critical depreciation are most copiously poured out. Among other things, Wundt's theory of psychophysical parallelism is said to be neither clear nor decided, and in different works we get different views. In support of this Heinrich cites passages from the Physiologie, Psychologie, from the Essays, and from the Menschen-und Thierseele. The writer does not find these passages contradictory; but it is hard to see why, if Heinrich was in doubt in regard to their meaning, he did not refer to Wundt's 'official' declaration in the treatise on "Psychical Causality and the Principle of Psychophysical Parallelism" in the *Phil. Studien* (B. X. S. 1 ff). Heinrich cites this article in another connection (p. 143), and it is almost incredible and certainly inexcusable that he should have taken the condensed and popular presentations of the theory in text-books or essays as a basis for criticism instead of the elaborate special treatise or even the discussion in the Logik. Again Heinrich finds that, according to Wundt, our consciousness is made up of ideas and sensations. Feeling being a quality of sensation (p. 104). Again and again Heinrich errs in this way; he either has not read other treatises necessary to an intelligent criticism of a writer, or he has failed to grasp their meaning. The chief points in Wundt which move Heinrich to an expression of critical approval are the "general laws of cerebral functions," and the "incisive attack on cerebral localization" (p. 95). In connection with Wundt, Heinrich criticises N. Lange's work on the Fluctuations of Attention: Heinrich finds that the conclusions drawn by Lange have been "shattered" by Münsterberg (p. 125), whilst the supplementary researches of Pace, Eckener, Marbe and Lehmann, are refuted by his own experiments.

Külpe fares quite as badly as Wundt. Besides holding, as noticed above, that Külpe's "Grundriss" is "scientifically of no importance," Heinrich finds that Külpe's own views rarely appear in his work, and when they do appear they are sterile. Külpe, we are told, tries to give us a descriptive psychology, but his habit of looking at things from the rationalistic standpoint has entangled him in the rationalism of Wundt's theory of apperception. Külpe may think he has treated his subject descriptively, but Heinrich warns him sharply that description is no mere "loose collocation." All this on p. 151. In consideration of this sort of criticism, Heinrich's complaint (in the appendix to the second edition) of the "authoritative tone" in Külpe's article on "Attention" (*Zeitschrift f. Phil. and philosoph. Kritik*, Bd. 110) has many of the elements of humor. Of Külpe's well-known chapter on "Reproduction and Association"—than which there is none weightier in any systematic treatise on psychology—Heinrich finds nothing better to say than that Külpe has failed to 'explain' the association processes physiologically.

In Münsterberg, however, Heinrich finds much to praise. Armed with the experimental method "Münsterberg stepped forth to the fray," *i. e.*, with Wundt; the result being that "Wundt's followers are steadily

decreasing." This result is probably as surprising to Münsterberg as to Wundt (p. 154). As contrasted with Wundt, Münsterberg is said to be freer from popular prejudice and keener in the analysis of his problems (p. 158). Still Heinrich finds Münsterberg wanting in the psychophysical test; in his discussion of association, for example, he limits himself to an analysis of the processes of consciousness instead of laying bare the underlying physiological processes. Ribot's theory of attention is criticised as representing Münsterberg's view.

Ziehen also is found not to be rigorous enough in the physiological side of his psychology (p. 175), in that he has asserted that there are factors in our mental life for which a material basis is wanting.

Even S. Exner's "Entwurf zu einer physiologischen Erklärung der psy. Erscheinungen" Heinrich does not consider strenuous enough physiologically; whilst in many ways he merits critical approval, still he too has "jumped over to consciousness" in his explanation instead of keeping to the nervous system.

With Avenarius's speculative views, so far as they can be applied to the concrete problems of psychology, Heinrich finds himself mostly in sympathy, and to an exposition of these views he devotes 23 pages.

The writer has thought he could better illustrate the worth of Dr. Heinrich's criticism by a résumé of his conclusions in regard to the authors he has discussed than by a critical review of his arguments—a long and probably not wholly profitable undertaking.

In regard to the way in which Heinrich has applied his psychophysical standard and his somewhat drastic treatment of Wundt, it may be considered an act of poetic justice to quote a passage from Wundt's Logik, written some time before the appearance of the first edition of "The Modern Physiological Psychology in Germany." In the second part of the "Methodenlehre" (2nd ed., p. 254), Wundt says "that a naïve ignorance of the actual standpoint of scientific thought is betrayed in the view sometimes found in psychological work, that, according to the principle of parallelism, a physical correlate belongs to every psychical process, and inasmuch as the physical chain of cause and effect offers the advantage of perfect continuity, a psychical process is really explained only when the corresponding physical processes are pointed out." F. A.

Des Indes à la Planète Mars. Etude sur un cas de somnambulisme avec glossolalie. Par TH. FLOURNOY. Paris, F. Alcan, 1900. pp. xii, 420.

Under the above somewhat dramatic title we have a close, detailed and exhaustive study of a new case of automatism. The subject, known as Hélène Smith, is an unmarried woman of thirty years, strong, healthy, vigorous and, excepting the automatisms to be mentioned, presenting no apparent physical or mental abnormalities. She holds a responsible position as clerk in a mercantile house, and is of unimpeachable character. As a medium, she is unpaid and non-professional. She is not a spiritist nor member of any spiritist society, though she has steadfast faith in the objective character of her revelations. Her father was a talented linguist, the linguistic habit being inherited by Hélène only subconsciously, as primarily she has a distaste for languages, and knows only French. From her mother she inherited her disposition to automatism. As a young girl she led a subjective life, given to brooding, sadness, nervous fear, a feeling of estrangement, and an antagonism to her humble environment to which she felt herself superior. It is well to note also a kind of subjective inventive talent exhibited, for instance, in embroidery work in which her hands moved almost automatically.

Mlle. Smith's automatism did not begin until she was about twenty-

two years old, when she was initiated by some friends into certain table tipping seances. She proved an apt subject, her mediumship exhibiting itself at once in the triple form of visual and auditory hallucinations and typtological manifestations. Three years later Professor Flournoy made her acquaintance and began his long and patient study of the case. But from this time her automatism took a more intense form, including, in addition to those mentioned, various hypnoid phenomena, such as the profound trance, anæsthesias, disturbances of motility, catalepsy, emotional attacks and systematic confusion of the right and left sides of the body. Furthermore, between the regular seances, Hélène is subject at any time to visual and auditory hallucinations, irruptions of subliminal dreams and useful subconscious automatisms.

As regards the content of the communications, they fall into four groups or cycles, somewhat like four continued stories. These are the Hindoo cycle, the Royal cycle, the Martian cycle and the Leopold cycle. The latter, however, is different from the others, as Leopold figures to some extent in all of them and bears a relation to Mlle. Smith somewhat similar to that formerly existing between Dr. Phinuit and Mrs. Piper. The Hindoo and the Royal cycles are based upon the pretended reincarnation of a Hindoo princess first as Marie Antoinette, and finally as Hélène Smith. She was the daughter of an Arab sheik, and under the name of Simandini became the wife of the Hindoo prince Sivrouka Nayaca, who, in the year 1401, built the fortress of Tchandraguiri. This pre-existence she attempts to prove by writing and speaking Arabic and Sanskrit and recounting certain historical events relating to this obscure epoch. The Martian cycle is still more dramatic, and is psychologically the most interesting of all. In trance Hélène discovers herself floating upward through stellar space and arrives upon the planet Mars. She describes the Martian inhabitants, their dress, manners and houses, and draws pictures representing scenes upon that planet. She speaks and writes the Martian language, and finally consents to translate it, word for word, into French. It is a veritable language, inflected, and capable, apparently, of expressing any thought, and is understood by the medium in its fourfold form of a language spoken, heard, written and read. The Martian texts produced are innumerable in number. Many of them, with their translations, are reproduced by the author in the text, together with some of the drawings of Martian scenery. The following is a short specimen of the language: *Dé véchi ké ti éfi mervé éni*, meaning, word for word, *Tu vois que de choses superbes ici*. There is a special script for writing the language resembling hieroglyphics.

The author's critical analysis of these automatisms as psychological phenomena is of a very thorough and systematic kind. This is particularly noticeable in unraveling the mystery of the Martian language. There have been many instances of glossolalia, but it has probably never happened before that one of these "tongues" could be reduced to writing, translated and studied in such detail. Professor Flournoy has brought skill and patience to this task, and it is, perhaps, the most valuable part of the present work.

I can give but the barest summary of the author's conclusions, which he puts forward only as hypotheses, maintaining throughout the book the greatest impartiality towards all shades of opinion. The Martian romance is a subconscious dream suggested probably by Flammarion's work and the interest in spiritistic circles at that time in communicating with the inhabitants of other planets. It is a product of constructive imagination of an essentially infantile character bearing marks of a subjective origin throughout. The Martian language is a puerile modification of French, not made up in cold blood by Hélène,

but is the long continued pastime of a peculiar subconscious personality inheriting linguistic tastes and taking childish delight in these creative fancies. Difficult as this hypothesis seems in its application to the formation of so elaborate a language, nevertheless it is fully confirmed by an experiment which the author himself finally made. He bluntly informed the medium of his opinion of the language and produced incontestible proofs that it was only a modified French, whereupon there followed in future seances an attempt to modify the language and correct its too apparent faults, producing an *ultramartien* unlike any other language. This truly is mental vivisection, and one wonders whether subconscious personalities are capable of feeling pain and weariness!

The Hindoo romance presents some greater difficulties. The facts narrated are finally traced to a single obscure and (unfortunately for the medium) unreliable historian named Marlès, whose work Professor Flournoy's hypothesis makes it necessary that Hélène must at one time have seen, although he admits that that seems improbable. The Arabic is limited to a single phrase and the Sanskrit, although it contains many Sanskrit words and some phrases, is for the most part a jargon.

The chapter on the supranormal is a relatively short one. The author continues in his attitude of fairness towards all theories, exhibiting as great contempt for the bigoted devotee of "science" who has accepted the *a priori* impossibility of the supranormal, and has, therefore, no interest in psychic research, as for the credulous spiritist who detects the spirit of his great aunt in every joggle of a table. He even goes so far, perhaps somewhat to the American reader's surprise, as to affirm his faith in telepathy and the movement of objects without contact. He admits, however, only unsatisfactory evidence for these in the case of Hélène, while all the appearances of clairvoyance, lucidity, incarnations and spirit manifestations are explainable as hypnoid phenomena.

As an example of method this book is to be highly commended, and method is what is needed now in the study of automatism. Any one who should complain that the case of Mlle. Smith is not sufficiently "remarkable" to merit 420 pages of minute description fails to understand the importance of the study of secondary personality. The author's intimations of the infantile and reversionary character of the secondary personality are of interest in the light of recent theories.

University of Iowa. G. T. W. PATRICK.

RECENT NEUROLOGICAL LITERATURE.

By COLIN C. STEWART, Ph. D.

The Nervous System and its Constituent Neurones, designed for the use of practitioners of medicine and of students of medicine and psychology: by LEWELLYS F. BARKER, M. B., Associate Professor of Anatomy in the Johns Hopkins University; 2 colored plates and 676 illustrations, pages xxxii and 1122. New York, D. Appleton & Co., 1899.

Although perhaps too technical for the average reader, and lacking, to a certain extent in completeness when considered from the purely physiological side, Prof. Barker's book will remain for many years one of the readiest and most useful works upon the subject. Systematic arrangement, wealth of detail in every subdivision, and profuse and

well chosen illustration, are characteristics which point to the value of the book for reference purposes. Nor is the list exhausted, for we have, in addition to a classified table of contents, a subject index of twenty-six pages, and an index of authors comprising approximately 750 names. Of the illustrations, many of which are original, we have slightly more than one to every two pages of text. Most are in clear line drawing, many are in half-tone, and not a few are in colors.

The first section, of six chapters, is devoted to the development of the neurone concept—the name "neurone" being applied as meaning "a cell belonging to the nervous system, with all its parts." A full historical presentation is made, with the conclusion that the neurone theory is supported by all the facts at our disposal. Reported findings to the contrary are to be regarded as exceptions of relatively rare occurrence. As to the results of Apáthy's work, as yet incomplete, judgment is of necessity reserved.

Section II, with three chapters and 31 illustrations, is devoted to the external morphology of neurones. There is an interesting reference to some of Nissl's later work and his theory that much of the non-cellular cortical gray matter is composed of an interlacing of fine fibrils, resembling neuropil, and not altogether of the dendrites of cortical cells. To these Nissl would attach the highest importance. And this from the closing paragraph of the section: "The whole doctrine, by means of which sleep, anæsthesia, the phenomena of hysteria, double personality, etc., are to be explained by amœboid movements of the dendrites, or the so-called "retraction theory," appears to be based on the single observation of Wiedersheim. . . . The idea has been severely criticised by von Kölliker, and it is worthy of note that a theory so feebly supported by facts has been so widely accepted and made the basis of a mass of clinical generalizations."

The internal morphology of neurones is treated of in the third section, with five chapters and 26 figures. Conflicting views as to ultimate structure are reviewed at length, and many details of staining and technique are given. Chapter XIV is a summary in four pages of our present incomplete knowledge of the internal structure of nerve cells.

The origin of the nervous system in the embryo and the early development of cells and cell relations, with a chapter on segmentation and the mechanical factors of development, are the subjects of Section IV, with 55 illustrations.

The next section is devoted to the neurone as a unit in physiological and pathological processes. The normal metabolism of the nerve cell is followed by a chapter on the degeneration and regeneration of nerves, in which the facts, the literature, and the various methods of demonstrating degenerative changes are fully treated. Chapters XXI, XXII and XXIII discuss the irritability of the neurone and many closely related questions, of which a few are: spontaneity, transference of excitation, the specific energies of nerves, the conducting function of the cell body and the dendrites, and the direction of conduction. The next two chapters treat of the histological changes as the result of fatigue, the influence of a large number of poisons, the effects of anæmia, and of conditions leading to secondary degeneration.

These five sections bring us to page 312. The remainder of the work, Section VI, is devoted to the working out of the topography and relations of the various groups of neurones as they go to form the complex nervous system of man and the mammals. And it is in this latter part of the book especially that we are indebted to the writer for the laborious care with which facts have been drawn together and systematically arranged. The section covers nearly 800 pages, with, roughly, 500 illustrations; and in writing it anatomical, physiological, pathological, embryological, and histological material are fully made use of.

The various groups of neurones are described in order, illustrated both by explanatory diagrams and by reproductions and figures. The peripheral centripetal neurones,—the sensory neurones of the first order,—are considered first, with 70 figures of peripheral sensory endings other than those of special sense, and many others. Then come those centripetal neurones within the central nervous system which connect the end stations of the first group with higher and higher levels—neurones of the second and higher orders. Under this heading are described the tracts in the cord, medulla and higher parts, and the grouping of their cells in nuclei and centers. After the centripetal come the centrifugal neurones of the first order, those connecting the central nervous system with the voluntary muscles of the body; and the centrifugal neurones of higher order, placing the first under the control of higher parts. Under this, among other things, localization of function in motor areas is dealt with. And lastly, four chapters are devoted to the projection, commissural and association neurones of the telencephalon.

The only thing left to be desired is a fuller presentation of the structure and relations of the sympathetic neurones, but as a matter of fact that is not central nervous system, and after all we already have a series of excellent papers by Huber.

The total number of functional cells in the cerebral cortex of man, and the percentage of the total volume of the cortex composed of nerve cell bodies, calculated from Carl Hammarberg's data; together with a comparison of the number of giant cells with the number of pyramidal fibres. HELEN B. THOMPSON: Journ. of Compar. Neurol., IX, No. 2, 1899. pp. 113-140, 2 figs.

Following the method of dividing the cortex into sixteen structurally uniform areas, the author has placed the determination of the number of functional cortical cells at 9,200 million. Only 1.37% of the total volume of the cortex is composed of cells, and the number of giant cells is almost the same as the total number of pyramidal fibres.

A note on the significance of the small volume of the nerve cell bodies in the cerebral cortex in man. H. H. DONALDSON: Journ. of Compar. Neurol., IX, No. 2, 1899. pp. 141-150.

Though of the utmost physiological importance, small differences in the mass of nerve cell bodies must escape detection by the method of weighing, for the total weight of all the nerve cell bodies in the brain is less than 27 grammes. This is less than half the range of variation in weight in groups of brains classified according to sex, mental power, stature or age. Hence these differences must be mainly in growth of medullary substance.

The number and arrangement of the fibres forming the spinal nerves of the frog. I. HARDESTY: Jour. of Compar. Neurol., IX, No. 2, 1899, pp. 64–112; Plates VI to XIII.

The number of fibres decreases in the ventral spinal root from the cord to the ganglion, and in the dorsal root, both ways from the ganglion; the difference being in the number of small, and presumably growing, fibres. The sum of the fibres in the trunk and dorsal branches of a spinal nerve exceeds considerably, in every case, the sum of those in both dorsal and ventral roots combined. The method used by Hardesty is an interesting one. Microphotographs of cross sections of nerves stained in osmic acid were made, and in these photographs the fibres were cancelled by the same movement that clicked an automatic counter.

On some numerical comparisons of the centripetal and centrifugal medullated nerve fibres arising in the spinal ganglia of the mammal. H. H. DALE: Jour. of Physiol., XXV, No. 3, 1900, pp. 196-206; Plate II.

There are in the cat about 0.5 per cent. more fibres in the trunk of a spinal nerve than in the two roots combined, the excess being caused by fibres of small diameter, going probably from the gray ramus to supply the blood vessels or other tissues of the ganglion. The author does not agree with Hardesty in finding fibres arising from cells in the ganglion to end close to it; and concludes from his measurements that fibres of both ventral and dorsal roots taper slightly in size as they pass away from the cord.

Observations on the weight and length of the central nervous system and of the legs in frogs of different sizes (rana virescens brachycephala, Cope). H. H. DONALDSON, and D. M. SCHOEMAKER, Jour. of Comp. Neurol., X, No. 1, pp. 109-132.

The male of this species rarely exceeds 50 grammes in weight, while the female may reach 75 g. or over. The weight of the brain in the largest males is, however, less than that in females of comparable size. This is in direct opposition to the finding published by Fubini in 1881, for *rana esculenta* and *rana temporaria*. The authors have also found that the relative weight of the brain, as compared with that of the spinal cord, decreases as the frog increases in size. This fact makes it possible that more exact comparisons would be made if male frogs of any given weight were compared, not with females of the same size, but with those in the same relative position in the scale of their range of growth. A full grown male frog is probably not comparable with a female frog of the same weight.

In frogs of all sizes the sum of the lengths of the leg bones, and the proportional lengths of the several bones, are nearly constant. The weight of the leg muscles, compared with body weight, increases up to 5 g. in weight, then decreases slightly as the frog increases in size.

A contribution to the study of the pyramidal tract in the central nervous system of man. W. G. SPILLER: Brain, No. 88, Winter 1899, pp. 563-574.

The Marchi method was applied in a case of tumor in the internal capsule and lenticular nucleus. Besides observing the homolateral fibres running with the crossed pyramidal tract, the author describes a tract which separates itself from the pyramidal fibres to lie external to the olivary body on the side of the lesion, and on the periphery of the cord in the upper cervical region. These are interesting when compared with the antero-lateral descending fibres which degenerate in the monkey after cortical lesion.

Spinal cord changes in cases of cerebral tumor. F. E. BATTEN, and J. S. COLLIER: Brain, No. 88, Winter 1899, pp. 473-533.

An examination of a large number of cases of cerebral tumor has led to the conclusion that degeneration in the posterior columns, which occurs in about 65 per cent. of the cases, is of root origin, is independent of the nature or position of the tumor, and is caused by intracranial pressure, distension of the subarachnoid space of the spinal cord, with traction on the spinal roots.

Observations on the ascending tracts in the spinal cord of the human subject. E. E. LASLETT, and W. B. WARRINGTON: Brain, No. 88, Winter 1899, pp. 586-592.

Two human cases, one of caries with disintegration of the mid-dorsal

cord, one of injury and destruction of the cord at the 10th dorsal root, were examined by the method of Marchi. Degenerated fibres in the postero-median column end above in the nucleus gracilis. In one of the cases fibres of the 4th posterior spinal root, lying in the middle of the postero-external column, end below at the level of the 5th and 6th, and above in the nucleus cuneatus, with collaterals passing to the cells of the postero-lateral group. Some degenerated fibres cross from the anterior horn on that side through the anterior commissure—the "crossed afferent fibres" of Edinger. The dorsal cerebella tract is followed through the restiform body to the cerebellum, and the ventral cerebellar fibres, including some lying along the ventral fissure, to a position external to the inferior olive from which they pass to the superior medullary vellum. Beyond that point their course was not followed.

On the evidence of the Golgi methods for the theory of neuron retraction. (Abstract.) R. WEIL, and R. FRANK: Archives of Neur. and Psychopath., Vol. II, Nos. 3-4, 1899.

The authors have found, in a study of 342 preparations from 43 animals, using the Golgi method, rapid, mixed and slow, and Cox's modification, that normal material, as well as toxic, is as a rule free from varicosities when treated by the slow method, while the more rapid methods show them in corresponding richness. The results from the same material vary with the method, and constant results are not always obtained from the same material treated by the same method. The conclusion is that the varicosities are to be regarded as artifacts of the Golgi method.

NOTES.

Reading without Articulation.

In a reference to my paper upon the above topic (this *Journal*, Jan., 1900, pp. 225 ff.), Mr. H. H. Bawden writes in his monograph, "A Study of Lapses" (*Psych. Rev.*, Supplement 14, April, 1900), as follows:

"We question the accuracy of the introspection in the case of the subject who is reported by W. B. Secor as not dependent upon the articulatory imagery in reading. There is no doubt that this author's conclusion is correct when he says that practice brings the visual imagery into greater prominence, but that it is possible to 'grasp the meaning of printed or written matter through the eye alone without the aid of articulatory images' is open to grave question. The probability is that the kinæsthetic imagery has changed from a gross to a finer type, say, from the grapho- or articulo-kinæsthetic to the imagery connected with the finer movements of the eye, but that it vanishes entirely is *a priori* improbable and *a posteriori* undemonstrated."

It seems clear that Mr. Bawden has here confused two different questions. We do not articulate with our eyes, and the sensations from eye-movement can therefore hardly be termed articulatory. Whether these sensations actually replace and stand for the articulatory sensations, and whether the presence of some kinæsthetic factor is indispensable to meaning, are questions which we did not touch upon.

Our point was this. In the case of the subject cited, neither introspection nor the Verdin laryngograph gave, under certain conditions, any evidence whatsoever of the presence of articulatory imagery. Thinking that introspection might be at fault, we tried to devise methods for its control (pp. 232 f.); and we were careful to say that the laryngograph has its limits (p. 233). Mr. Bawden's criticism, therefore, simply mentions one of the two sources of error (the uncertainty of introspection) to which we ourselves called attention, and, as it happens, the one which we think was ruled out by our procedure. What is now wanted is work with other subjects, and more especially a more delicate form of laryngograph.

W. B. Secor.

Early Memories.

I wish to call the attention of such psychologists as may not yet have seen it to President Hall's paper in the *Pedagogical Seminary* for December, 1899, entitled "Note on Early Memories." The article is one of extreme interest, and arouses a very flood of introspective reminiscence in the reader. It is also of great importance from the genetic standpoint, and should receive careful criticism and consideration from workers in the genetic field.

I mention here two passages only, which show a welcome sameness of result from the fields of genetic and of structural psychology. On p. 512 the author says: "The act of recall itself has, I think, in every case had a certain unique kind of pleasure attaching to it." This tallies well with the laboratory verdict: "Every recognitive experience is intrinsically pleasant," (my *Outline of Psychology*, 1899,

p. 275). Again, we read (p. 486) of "things that brought a distinct sense of familiarity, but no trace of anything like memory;" *cf.* the discussion following, and especially the wild-rose bush incident on p. 489. All this agrees admirably with the laboratory analyses of 'reduced' recognition or direct apprehension (*Outline*, p. 278), and of organic memory (*Ibid.*, p. 293).

The value of work of this kind can hardly be overestimated. It emphasizes the oneness of psychology, by whatever method we approach the problems of mind.

E. B. T.

Fluctuation of Tones.

Mr. H. O. Cook found, in opposition to Dr. W. Heinrich, that liminal tonal stimuli show the intensive variations known as 'fluctuations of attention' (this *Journal*, October, 1899, pp. 119 ff.). Dr. Heinrich has just published a new investigation upon the subject (*De la constance de perception des tons purs à la limite d'audibilité*, in the *Bulletin international de l'academie des sciences de Cracovie*, Jan., 1900, pp. 37 ff.). He finds that pure tones (*i. e.*, tones free from all admixture of noise) do not fluctuate; the fluctuations in Mr. Cook's experiments were due to the presence of noises, "bruits à peine perceptibles."

Dr. Heinrich's result is surprising, in view of the introspective verdict that the tone, heard as tone, fluctuates. It must, however, be accepted as the last experimental work upon the subject. Meantime, we had ourselves planned (and have begun) a continuation of Mr. Cook's investigation, with purer tone sources. We shall return to the question as soon as a result, positive or negative, has been reached. It is needless to say that the issue is one of high theoretical importance.

E. B. T.

COMMUNICATION.

The following letter, written without thought of publication, is printed by the author's permission. It was the second addressed to the editor in response to a second urgent letter from him requesting a sitting with Mrs. Piper. It is printed here with the thought that it may interest and inform other psychologists who may seek interviews.

Boston, Mass., Feb. 24, 1900.

Dear Dr. Hall:

In reply to your further letter of Feb. 23rd, I fear that my previous letter, perhaps owing to its brevity, did not sufficiently explain the situation as regards Mrs. Piper. I shall describe it in further detail as it purports to be from the point of view of the communicators through Mrs. Piper's trance.

In the attempt to get proof of personal identity from the Rev. W. Stainton Moses, who died in 1893, I came into relation with certain intelligences that claimed to have been the chief spirit instructors of Stainton Moses for some years during his life time, and whom he called by the names *Imperator*, *Doctor*, *Rector*, etc. Imperator was alleged to be the leader and general supervisor in connection with the supernormal experiences of Stainton Moses, accounts of which will be found in the Proceedings S. P. R., Parts XXV and XXVII. Imperator, communicating through Mrs. Piper's trance, very soon claimed and assumed the supervision of the trances. I definitely agreed to this supervision. For a number of years prior to this time I practically

made such arrangements as I pleased as regards the introduction of fresh persons to sittings with Mrs. Piper. Imperator stated that it was impossible that the best work could be achieved from their side under such conditions, that Mrs. Piper's organism regarded as a machine had been "battered and worn," that it needed much repairing, that the utmost care must be taken as regards the persons introduced on the earthly side, and the persons allowed to use the machine from the so-called spirit side. For the purpose of securing proper conditions, Imperator claimed that they on their side could alone decide what persons should be allowed to communicate, as they alone could determine what conditions might be beneficial to, and what injurious to the machine. General experimenting by persons on this side was prohibited. Opportunities have been given for the introduction of fresh persons to the trance. These, however, have been few in number. The introduction of fresh persons at the present time has been absolutely prohibited. Imperator has stated that the conditions are such that it would interfere with the work which they have to do in improving the machine and in other matters if fresh sitters were now introduced. All this has been explicitly laid down without any doubt, and I am bound by my agreement.

This Imperator regime began at the latter part of January, 1897, and I refer you to section 7 of my report in Part XXXIII of our Proceedings, entitled "Recent Changes in Mrs. Piper's Trance," pp. 407–12.

During my year's absence in England, from September, 1897, to September, 1898, various fresh persons were allowed to have sittings besides a group of persons who were previously familiar with Mrs. Piper's trance. Later on, however, after my return here, a much closer restriction was exercised by Imperator. Only about half a dozen fresh persons were allowed to go at all during last season, and at the present time no fresh persons are allowed to be introduced.

I have had, I think, hundreds of applicants for sittings during the past year. I have had four new applications besides your own this week.

Several persons have had the opportunity of having sittings about once a fortnight, and Mrs. Piper goes into trance now usually only three times a week. It is probable that later on even this small group of persons will be restricted.

Briefly, once more then, the situation is that the matter at present is out of my direct control. I have agreed, so to speak, to let Imperator manage the machine. Absolutely explicit instructions have been laid down by Imperator that no persons shall be admitted to the sittings except as appointed by him. It is not likely that any fresh persons will be allowed to have sittings in the future at any time, except such as are in special grief for the recent loss of near friends or relatives.

As to the general wisdom of this management by Imperator, I have myself personally no doubt. It would, however, take me too long to explain my view of the situation at length in a letter. I refer you again to section 7 of my report in Part XXXIII for some suggestions in this direction, which I expect to work out more fully in later reports.

From my own point of view, Mrs. Piper's organism as a medium of communication from the other side to this represents an extremely delicate machine, which is likely to get out of order unless the utmost care is taken as regards the conditions. This is not realized by the ordinary person; and yet we know well that even in cases which are probably enormously less complex, absolute exclusion is necessary. There are, *e. g.*, machines used in physical experiments which are isolated in such a way that observers are not permitted to even enter

the room in which the machine is placed. And yet persons who are completely ignorant of the conditions, both general and special, under which the communications through Mrs. Piper come, actually feel aggrieved that they cannot in succession try their apprentice hands and the apprentice hands of their spirit friends at the working of such a complicated and delicate machine as Mrs. Piper's organism.

Yours sincerely,

R. HODGSON.

BOOKS RECEIVED.

CARPENTER, EDWARD. A visit to a Gñani. From Adams Peak to Elephanta. Alice B. Stockham & Co., Chicago. Price, $1.00.

CARUS, PAUL. The soul of man. An investigation of the facts of physiological and experimental psychology. 2d ed. With 182 illustrations and diagrams. Open Court Pub. Co., Chicago, 1900. pp. 482 (The Religion of Science Library, No. 41. Price, 75 cts.).

COE, GEORGE A. The spiritual life. Studies in the science of religion. Eaton & Mains, New York, 1900. pp. 279. Price, $1.00.

FOLKMAR, DANIEL. Leçons d'anthropologie philosophique. Ses applications à la morale positive. Schleicher Frères, Paris, 1900. pp. 336. Price, Fcs. 7.50.

FOUILLÉE, ALFRED. La france au point de vue moral. Félix Alcan, Paris, 1900. pp. 416. Price, Fcs. 7.50.

LEVY-BRUHL, L. La philosophie d'Auguste Comte. Félix Alcan, Paris, 1900. pp. 417. Price, Fcs. 7.50.

MONCALM, M. L' origine de la pensée et de la parole. Félix Alcan, Paris, 1900. pp. 316. Price, Fcs. 5.

ROYER, MADAME CLÉMENCE. La constitution du monde. Dynamique des atoms, Nouveau principes de philosophique naturelle. Schleicher Frères, Paris, 1900. pp. 800. Price, Fcs. 15.

SOLLIER, PAUL. Le problème de la mémoir. Essai de psycho-mecanique. Félix Alcan, Paris, 1900. pp. 218. Price, Fcs. 3.50.

STARBUCK, EDWIN D. The psychology of religion. An empirical study of the growth of religious consciousness. With a preface by Wm. James. Imported by Charles Scribner's Sons, New York, 1899. pp. 423. Price, $1.50.

SWEDENBORG, EMANUAL. On Tremulation. Translated from the photo-lithographed copy of the Swedish MS., by C. Th. Odhner. Massachusetts New-Church Union, Boston, 1899. pp. 79. Price, 50 cts.

TANON, L. L' évolution du droit et la conscience sociale. Félix Alcan, Paris, 1900. pp. 166. Price, Fcs. 2.50.

THILLY, FRANK. Introduction to ethics. Charles Scribner's Sons, New York, 1900. pp. 346. Price, $1.25.